
CHAPTER 2 - PLANNING AND MANAGEMENT OF ASSETS AT SNL/NM FACILITIES

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1.0 THE DECISION PROCESS FOR MANAGEMENT OF PHYSICAL ASSETS

The Facilities Business Unit, which includes the Operations & Engineering Center (7800) and the Facilities Management Center (7900), coordinates decisions about the management of facilities, infrastructure, and sites. These decisions include the following:

- New construction, including siting
- Relocation
- Decontamination and decommissioning
- Rehabilitation, and renovation
- Mothballing
- Demolition

Decisions on these matters flow from a corporate decision process in which SNL directors and vice presidents identify the facility and infrastructure requirements for carrying out work for DOE and other customers. DOE and any non-DOE owners of real estate that is leased or permitted to DOE for SNL/NM use must concur with this identification of requirements.

Decision-making follows procedures required by DOE and requirements defined by SNL/NM program executives. See Sandia National Laboratories (1997e), Part II, "Desired Future State and Strategy," and appendices to Sandia National Laboratories (1997e) for more information about planning and decision processes. Decisions on siting take surrounding land uses into account and draw on environmental baseline information maintained at SNL/NM. For environmental baseline and land use information, see Sandia National Laboratories (1999).

2.0 PROGRAMS FOR PLANNING AND MANAGEMENT OF ASSETS

Facility planning and maintenance, procurement, and security activities provide essential facilities and infrastructure support to SNL/NM. This section describes relevant activities in the following centers:

- Safeguards and Security Center (7400)
- Facilities Business Unit:
 - Operations & Engineering Center (7800)

- Facilities Management Center (7900)
- Procurement & Logistics Center (10200)

2.1 Safeguards & Security (7400)

Programs at the Safeguards & Security Center (7400) safeguard SNL against possible theft, loss, or sabotage of nuclear materials and classified information. This center also controls access to work areas, information, and communications.

2.1.1 Nuclear Material Control and Accountability

The Material Systems and Security Audits Department (7442) safeguards special nuclear material, source nuclear material, and other nuclear material. Primary activities of this department include the following:

- Determining nuclear material types and corresponding accountable quantities.
- Controlling, inventorying, and tracking all accountable quantities of nuclear material within material balance areas through the SNL Local Area Network Material Accountability System (LANMAS).
- Communicating material access control requirements for categories of nuclear material.
- Approving and processing all requirements for the purchase of nuclear material.
- Verifying all information for and authorizing internal transfers in the SNL LANMAS.
- Coordinating external transfers of nuclear material between authorized facilities to ensure adequate control and accountability.
- Responding to incidents that involve threats against SNL or the public involving nuclear materials or whenever there is reason to suspect that nuclear material or items containing nuclear material may have been lost, tampered with, or illicitly diverted.

(Sandia National Laboratories, 1998a)

2.1.2 Physical Protection of Assets

The Security Requirements and Planning Department (7432) provides guidance and requirements for the physical protection of assets and provides the following services:

- Processing of all classified facility plans.
- Providing assistance and guidance for establishing control procedures to detect and deter unauthorized access to security areas or removal of security interests from security areas.
- Establishing security plan requirements and protective measures for classified matter used outside a limited or exclusion area.
- Approving any classified work that takes place outside an approved area.
- Providing information concerning structural and alarm requirements for vaults and vault-type rooms.
- Providing expertise in protecting unclassified controlled access information.
- Assisting organizations in determining property protection requirements, evaluating effectiveness of current protection measures, and developing property protection procedures and plans.

Other services regarding the protection of physical assets offered by other organizations within the Safeguards & Security Center (7400) include the following:

- The Protective Force Department (7435) provides Protective Force coverage, as necessary.
- The Electronic Security Systems Department (7433) provides consultation on all matters regarding the purchase and installation of intrusion detection systems.
- The Classification and Sensitive Information Review Department (7447) provides independent review of unclassified, controlled-access information as part of the review and approval process.

(Sandia National Laboratories, 1998a)

2.1.3 Computer Security

The Computer Security Program provides information to assist SNL personnel in meeting their responsibilities for computer security, which include:

- Knowing and following SNL computer security policies and procedures, particularly those relating to the systems accessed.
- Knowing the sensitivity of and the protection requirements for the information accessed or processed.
- Properly marking, handling, and storing sensitive information.
- Ensuring that secure computing resources (classified) are not connected to nonsecure resources.
- Acquiring computer software from reliable sources to avoid viruses.
- Following copyright and other laws pertaining to intellectual property.
- Reporting any actual or suspected computer security incident to proper authorities.

(Sandia National Laboratories, 1998a)

2.1.4 Security Education and Awareness Program

The Security Education and Awareness Program ensures that employees and subcontractors are equipped to protect sensitive and classified information. The objective of this program is to motivate and instill a high level of security awareness in individuals that ensures the protection of national security interests (Sandia National Laboratories, 1998a).

2.1.5 Operations Security Program

The purpose of the Operations Security (OPSEC) Program is to disrupt or defeat the ability of foreign intelligence or any other adversary to exploit sensitive activities or information and to prevent the unauthorized disclosure of such information.

The main elements of the OPSEC Program include the following:

- OPSEC assessment, which supports efforts to ensure that proper protection is rendered to classified, sensitive, or proprietary information whenever significant changes occur in existing programs
- OPSEC review, which determines if additional security is necessary to protect specific activities and which determines if OPSEC assessments need to be modified
- Safeguards and security liaison for construction and relocation of organizations
- Imagery intelligence, which involves monitoring of all field tests and notification of the appropriate field test site manager in the event of an imagery intelligence threat, such as a flyover
- Assistance for subcontractors in establishing and maintaining their own OPSEC programs
- Awareness presentations
- Assistance to DOE and SNL organizations regarding the status of international weapons verification treaties

(Sandia National Laboratories, 1998a)

2.1.6 Classified Work for Others and Special Access Programs

Classified Work for Others and Special Access Programs ensure compliance with DOE orders and SNL policies and ensure that information or materials are properly classified, accounted for, and protected as required by the directives of DOE, the needs of the involved SNL organization, and the requirements of the program sponsors. A representative of this program identifies and maintains an accountability of all classified work for others and special access programs and acts as liaison with the DOE Kirtland Area Office, DOE Albuquerque Operations Office, and DOE Headquarters to assist in developing safeguards and security procedures and in maintaining a level of security acceptable to DOE and SNL program sponsors (Sandia National Laboratories, 1998a).

2.1.7 Counterintelligence Program

The Counterintelligence Program establishes a counterintelligence function for SNL. The program includes four main functions:

- Awareness and education, which seeks to ensure that SNL personnel are knowledgeable about:
 - The threat posed by foreign intelligence services
 - Reacting to threats and countering or neutralizing them within the framework of the DOE counterintelligence program consistent with the requirements of national security
- Intelligence community liaison
- Intelligence and counterintelligence briefings and debriefings, which assess the extent and content of the efforts of foreign intelligence services to obtain vital information from the United States and particularly from SNL
- Data analysis, which is used for developing future briefings and debriefings and for liaison with the intelligence community

(Sandia National Laboratories, 1998a)

2.1.8 Protective Force Services

The protective force protects SNL assets and also provides other services, including the following:

- Key service
- Emergency response
- Building access and securing
- Lock and key control
- Drug and bomb searches
- Escort support
- Safe and vault monitoring
- Employee protection
- Access control
- Security consultation

(Sandia National Laboratories, 1998a)

2.1.9 Other Safeguards & Security Center (7400) Programs and Services

Other Safeguards & Security Center (7400) programs and services include the following:

- Security clearances
- Procurement and issue of locking devices to protect classified matter and other security interests
- Access control
- Technical surveillance countermeasures program

(Sandia National Laboratories, 1997a)

2.2 Facilities Business Unit

The Space and Sites Planning Services Business Unit includes the Operations & Engineering Center (7800) and the Facilities Management Center (7900). The mission of the Space and Sites Planning Services Business Unit is to:

- Manage and maintain existing buildings and utilities.
- Plan, modify, and construct new buildings.
- Demolish substandard structures.
- Provide sites services in a safe and cost-effective manner.

(Sandia National Laboratories, 1998h)

2.2.1 Electrical Engineering

The Electrical Engineering Department (7821) provides the following services:

- Service contract administration

- High-voltage maintenance engineering
- Power and utility outage management and notification
- Design and construction quality assurance review and consultation
- Engineering consultation
- Contractor key service administration
- Relamping upgrades
- Utility repair

(Sandia National Laboratories, 1998e)

2.2.2 Corporate Projects

The Corporate Projects Department (7832) is responsible for project or construction management of all line item, general plant, and major renovation projects. The department works closely with the Planning & Project Development Department (7932).

(Sandia National Laboratories, 1998c)

2.2.3 Facilities Maintenance Program

The Facilities Maintenance Program Department (7841) is responsible for the following:

- Maintenance management program
- Energy management program
- Operations and restoration program

(Sandia National Laboratories, 1998i)

2.2.4 Electrical, Structural & Landscaping Services

The Electrical, Structural & Landscaping Services Department (7842) provides maintenance teams for the following:

- High-voltage (transmission and distribution), low-voltage, and fire, and intrusion detection and reporting systems
- Security perimeter and parking lot lighting, standby generator plant, lightning protection, and emergency lighting systems
- Structural sheetmetal and building structural support for balance alignment and repair of mechanical rotating equipment
- Landscaping and gardening

(Sandia National Laboratories, 1998f)

2.2.5 Mechanical Infrastructure

The Mechanical Infrastructure Department (7843) provides maintenance teams for the following:

- Steam plant
- Water treatment
- Backflow prevention
- Mechanical utility systems
- Generator support
- Heavy equipment (for example, mobile cranes and graders)
- Excavations, roads, and grounds

(Sandia National Laboratories, 1997b)

2.2.6 Custodial Matrixed Services

The Custodial Matrixed Services Department (7845) provides the following at SNL facilities:

- Custodial services, including:
 - Restroom cleanup
 - Wet mopping
 - Customer special requests
 - Dust mopping
 - Vacuuming
 - Emergency custodial services
- Trash pickup
- Recycling pickup
- Heavy floor care maintenance
- Sharp item disposal

(Sandia National Laboratories, 1998d)

2.2.7 Centralized Services

The Centralized Services Department (7846) provides support services for the Facilities Business Unit. Specific activities include the following:

- Identifying and coordinating training for facilities personnel and providing training consultation services.
- Providing warehouse services for cradle-to-grave management of repair and maintenance material and office furniture.
- Planning Facilities Business Unit maintenance activities.
- Providing technical expertise and subject matter experts in the area of cranes and hoists, roll-up doors and gates, maintenance of roofs, and locksmithing.

(Sandia National Laboratories, 1998b)

2.2.8 Fleet Management Services

The Fleet Management Services Department (7899) provides the following services:

- Performs preventive maintenance and repairs on SNL vehicles.
- Ensures that the vehicles are properly marked and operate in a manner that complies with federal and state regulations.
- Maintains required records on SNL vehicles.

2.2.9 Facilities ES&H

The Facilities ES&H Department (7919) is home to the Facilities Asbestos Implementation Team (FAIT) and the Construction ES&H Council, a collective body of staff and management personnel responsible for advising and reporting construction program status. The Facilities ES&H Department (7919) provides the following services:

- Maintains documentation on the following:
 - Inspector/observer logs and health physics surveys for facilities activities
 - Environmental restoration (ER) site reviews
 - Safety plans and meetings
 - Self-assessments and audits
 - Waste management and PCB inventory
 - Accumulation area documentation
 - OSHA tracking system
 - Project management tracking system
- Provides a basic OSHA training course for SNL construction staff who are directly involved in the management or inspection of construction operations.
- Conducts special training as necessary to respond to incidents and to inform SNL staff of new regulatory requirements.
- Provides continual acquisition, maintenance, and processing of requirements documentation applicable to facilities activities.

- Requires construction contractors to submit safety plans on a per-contract basis.
- Maintains and revises the SNL Standard Specification 01065, "ES&H Requirements," which is included in all construction contracts.
- Provides new contractor orientation on SNL ES&H requirements and expected performance levels.
- Provides training, films, newsletters, meetings, and posting of information for SNL facilities employees and contractors on ES&H requirements and responsibilities.
- Maintains the construction help line to report construction issues and suspected violations.
- Distributes the construction ES&H newsletter, *Construction News Sense*.
- Maintains SNL safety awareness bulletin boards, located outside the construction management/acceptance offices and at each construction site.
- Conducts internal assessments to determine compliance with ES&H and OSHA requirements, indicates any substandard performance areas, and recommends corrective action.

Facilities ES&H processes include the following:

- Building modification hazards assessments
- ER site review for any facilities that involve soil disturbance
- Proper identification and management of orphaned waste
- Maintenance support, safe shutdown, and isolation of mechanical systems during mechanical outages, and safe reenergization of systems after outages
- Water line disinfecting to conform with applicable New Mexico Environmental Department and American Water Works Association standards
- Supply procurement for spills or hazardous waste

- Survey of construction material and equipment for radiological concerns and hazardous materials
- Prevention of release of asbestos fibers above *Asbestos Hazards Emergency Response Act* levels, and integrating asbestos abatement into construction and maintenance projects
- Spill response and reporting, including proper containment, cleanup, and disposal of waste
- Monitoring of types and quantities of liquid discharge to the ground or sanitary sewer system to minimize environmental impact at construction and maintenance sites
- Removal of polychlorinated biphenyl (PCB) ballast and transformers
- Management of nonhazardous, nonradiological, and nonasbestos solid waste at all construction and maintenance sites
- Industrial hygiene and health physics response and support for construction and maintenance personnel

(Sandia National Laboratories, 1997a)

2.2.10 Facilities Express

The Facilities Express Department (7923) provides expedient design, layout, and construction services that include surveys and samplings to identify hazards in suspect materials and locations. If hazards are detected, procedures are implemented to ensure safe avoidance or disposal of such hazards in compliance with all ES&H requirements (Sandia National Laboratories, 1998g).

2.2.11 Sites Planning

The Sites Planning & Project Development Department (7932) is responsible for integrating SNL's current and future physical plant capabilities, site stewardship responsibilities, and mission needs of both SNL and DOE into plans for the development and redevelopment of SNL's sites, infrastructure, and the facilities to provide facilities that are "fit for use" in a cost-effective manner. The Sites Planning & Project Development Department (7932) provides the following:

- *SNL Sites Comprehensive Plan*
- *Sites Integrated Master Plan, Sandia National Laboratories*
- Decontamination, Decommissioning, Demolition, and Reuse Program
- Space Consolidation Program
- Campus design guidelines

(Sandia National Laboratories, 1998j)

2.2.12 Space and Real Estate Management

The Space and Real Estate Management Department (7934) is responsible for:

- Consolidating personnel within existing facilities.
- Consolidating personnel from temporary (high-energy and high-maintenance buildings) into permanent “core” facilities to reduce the occupation of temporary and substandard space.
- Consolidating isolated pockets of vacant space into blocks of sufficient size to support re-occupancy by whole organizations.
- Directing moves in support of the Major Rearrangement and Decontamination, Decommissioning, Demolition, and Reuse programs.
- Controlling, reassigning, or closing unused facilities.
- Analyzing the effectiveness of space utilization relative to SNL space standards.
- Ensuring that systems furniture, once installed, remains in place for future tenants.
- Interfacing with the tenant to address space and real property issues.

(Sandia National Laboratories, 1997f)

2.2.13 Fire Protection

The Corporate Fire Protection Council owns the Corporate Fire Protection Program, which is managed by the Corporate Fire Protection Program Manager in the Facilities ES&H Department (7919). This program organizes and drills evacuation and fire teams and coordinates with the local fire department and other emergency responders.

The Corporate Fire Protection Program includes seven key elements:

- Management to ensure that the program is properly administered and documented
- Training to ensure that general personnel and fire protection, and building evacuation teams are properly trained in their fire protection responsibilities
- Design and construction consulting and review to ensure that fire protection requirements are incorporated into construction documents and construction projects are inspected prior to final acceptance by SNL
- Fire protection engineering to ensure that fire hazards, loss potentials, assessments, impairments, life safety, and investigations are conducted by qualified fire protection personnel
- Fire prevention to ensure that inspections, permit and log systems, security fire watches, and plant shutdown procedures are performed and documented as required
- Inspection, testing, and maintenance to ensure that fire protection systems are inspected, tested, and maintained by qualified personnel
- Emergency response liaison to ensure that SNL meets its fire protection responsibilities to prevent loss of life and property in the event of fire

(Sandia National Laboratories, 1996)

2.3 Procurement & Logistics Center (10200)

Logistics personnel provide personal property management support and packaging and transportation support to all SNL/NM line organizations and are also responsible for SNL/NM mail services.

2.3.1 Shipping, Receiving, and Mail Services

The Shipping, Receiving, and Mail Services Department (10263) provides the following services:

- Receipt and processing of incoming purchased products
- Collection, processing, and distribution of mail
- Packaging, routing, and shipping of material and equipment and routing of inbound freight

(Sandia National Laboratories, 1997d)

2.3.2 Reapplication

Reapplication activities at SNL are managed by the Property and Reapplication Services Department (10267). Major activities of this department include:

- Inspecting, sorting, redistributing, and disposing of material and equipment
- Property management support to line organizations
- Managing and inventorying precious metals

(Sandia National Laboratories, 1997c)

2.3.3 Storage, Transportation, and Distribution Services

Storage, transportation, and distribution services at SNL are managed by the Storage, Transportation & Distribution Department (10268), which is divided into three teams:

- Nuclear/Radioactive/General Storage and Transportation Team, which provides storage, packaging, and onsite transportation for nuclear and radioactive material and provides storage and onsite transport to and from storage for all general material
- Explosives Storage and Transportation Team, which provides storage, packaging, and onsite transportation for explosive material

- Transportation and Distribution Team, which provides:
 - Onsite transportation for hazardous or nonhazardous property and material
 - Offsite transportation for hazardous or nonhazardous property and material
 - Chauffeur service for personnel transport on site and off site (for example, tours)
 - Recycling and sanitation pickup
 - Distribution of received products

(Sandia National Laboratories, 1997g)

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CHAPTER 3 - SAFETY, HEALTH, AND ENVIRONMENTAL PROTECTION AT SNL/NM FACILITIES

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1.0 INTRODUCTION

This chapter describes the environment, safety, and health (ES&H) services in place at SNL/NM that are essential to the support of SNL's mission-driven activities. The inherent occupational and environmental hazards present in performing these types of activities require precautions and controls commensurate with hazards. SNL is committed to performing its strategic mission without adverse effects on the environment or the health of its employees and the public.

ES&H programs at SNL/NM facilitate compliance with federal, state, and local regulations, DOE directives (policy, rules, orders, notices, standards, and guidance), and SNL's internal management policies. Because ES&H is a discipline that touches all SNL organizations and activity areas, many ES&H organizations work with other organizations within SNL/NM.

2.0 THE INTEGRATED SAFETY MANAGEMENT SYSTEM (ISMS)

The management of safety at SNL governs the identification, categorization, and analysis of the hazards and the development, implementation, and continuous improvement of the hazard controls at SNL/NM facilities that are discussed in subsequent chapters of the *Sandia National Laboratories/New Mexico Facilities and Safety Information Document*. SNL's strategy for identifying, categorizing, and analyzing hazards and for developing and implementing controls for those hazards is set forth in SNL's integrated safety management system (ISMS).

SNL has recently developed and begun roll-out of the ISMS, which establishes the following guiding principles:

- Line management is responsible for safety.
- Roles and responsibilities are clear.
- Competence is commensurate with responsibilities.
- Priorities are balanced.
- Safety standards and requirements are identified.

- Hazard controls are tailored to the work being performed.
- Authorization to operate is clearly established.

For a complete description of the ISMS, see Guth and Madigan (1998).

2.1 The Five Basic Management Functions

The seven guiding principles are implemented through the following five safety management functions:

- Define scope of work.
- Analyze and categorize hazards.
- Develop and implement controls.
- Perform work.
- Obtain feedback and improve.

(Guth and Madigan, 1998)

2.2 Defining the Scope of Work

Definition of the scope of work begins by identifying mission objectives, translating them into a definition of work that will meet those objectives, setting ES&H expectations, and prioritizing tasks and resources. An important part of this function is to perform work planning and allocate resources to ensure that work is performed safely.

- The *Sandia Strategic Plan 1997* (Sandia National Laboratories, 1998f) specifies mission objectives and ES&H objectives based upon Sandia's Management and Operating Contract (U.S. Department of Energy, 1994). An operating plan (Sandia National Laboratories, 1998b) is developed yearly to plan SNL's direction and to establish annual milestones, including the relationship of ES&H activities to other work.

Using the guidance in the *Sandia Strategic Plan 1997* (Sandia National Laboratories, 1998f) and the *Institutional Plan, FY1998-2003* (Sandia National Laboratories, 1997e), SNL program

managers and project managers develop work plans and allocate resources to ensure that the proper ES&H protective measures are incorporated into the performance of all work activities at SNL.

The people who direct day-to-day work have primary responsibility for ensuring that the necessary ES&H provisions and support are incorporated into work plans. Program managers, project managers, and line managers work to secure adequate resources for projects, including resources necessary to fund required ES&H support activities (Guth and Madigan, 1998).

2.3 Analyzing and Categorizing Hazards

2.3.1 Hazards Analysis and Categorization for All Facilities

Analysis and categorization of the hazards and risks to workers, the public, and the environment include identifying and analyzing the work hazards and risks and categorizing the facilities and work activities according to hazard levels (Guth and Madigan, 1998).

To analyze and identify hazards, SNL uses the primary hazards screening (PHS) software module of the Integrated Safety Management System (ISMS) Software, which allows SNL organizations to identify hazards, hazard classifications, training requirements, and required safety documents.

The ISMS Software consists of a collection of Emergency Operations Center (EOC) and hazard analysis modules that are integrated to minimize the amount of information a user must provide and that allow for rapid update of information across the risk management spectrum. (Some of these modules are currently under development.) Personnel may use the PHS module as a project planning tool by answering questions in various ways in the PHS interview and then recalculating results to examine the effects of hazard reduction or elimination on the project cost and schedule (Sandia National Laboratories, 1999).

The PHS module classifies hazards in SNL facilities and project activities as:

- “Office hazard.”

- “Standard industrial hazard” for facilities or project activities with material or equipment available commercially that is used according to:
 - The manufacturer's instructions (or MSDS in the case of chemicals).

- The material or equipment design intent or purpose.

- “Low-hazard nonnuclear” for facilities or project activities that have the potential for minor onsite impacts (within the boundaries of SNL-controlled areas) and negligible offsite impacts (outside the boundaries of SNL-controlled areas) to people or the environment. Low-hazard nonnuclear facilities or operations have the potential to present:
 - Significant damage to the experiment or operational area (temporary loss of the use of the equipment or facilities).
 - Minor injury to the workers involved in the activity, including exposures that are unlikely to produce more than minor injury or temporary discomfort (for example, cuts, bruises, and minor burns).
 - Negligible (unmeasurable) injury to workers not involved in the project or activity and offsite people.
 - Negligible impact to the offsite environment (outside the boundary of SNL-controlled areas).

- “Moderate-hazard nonnuclear” for facilities or project activities that present considerable potential onsite impacts to people or to the environment but only minor offsite impacts, at most.

- “High-hazard nonnuclear” for facilities or project activities with the potential for onsite or offsite impacts on large numbers of people or for major offsite impacts on the environment.

- “Hazard category 3 nuclear” for facilities whose hazard analyses show the potential for only significant localized consequences. Hazard category 3 nuclear facilities are those with quantities of hazardous radioactive materials that meet or exceed the values in Attachment 1, Table A.1 of DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance With DOE Order 5480.23, Nuclear Safety Analysis Reports*.

- “Hazard category 2 nuclear” for facilities whose hazard analyses show the potential for significant onsite consequences. Hazard category 2 nuclear facilities are those with the potential for nuclear criticality events or with sufficient quantities of hazardous material and

energy to require onsite emergency planning activities according to Attachment 1 of DOE-STD-1027-92.

- “Accelerator” for devices employing electrostatic or electromagnetic fields to impart kinetic energy to molecular, atomic or subatomic particles that are capable of creating a radiological area as defined in DOE 5480.25.

(Sandia National Laboratories, 1999; Mahn, 1996b)

2.3.2 Additional Hazards Analysis for Higher-Hazard Facilities

The output of the PHS module of the ISMS Software indicates requirements for additional safety documentation as follows:

- For low-hazard nonnuclear facilities or project activities, the PHS indicates that personnel who are familiar with the potential hazards in those facilities must complete a hazards analysis from within the ISMS Software package in addition to the PHS.
- If the PHS output indicates that a hazards assessment document for emergency planning may be required, organization or project managers who are responsible for facilities, operations, activities, or projects must ensure that personnel who are familiar with the respective hazards contact a risk management specialist regarding this requirement. Personnel from the ES&H Teams & Risk Management Department (7523) develop hazards assessment documents where those documents are necessary.
- If the facility is not a standard industrial hazard or low-hazard nonnuclear facility or project activity, the PHS indicates that personnel who are familiar with the potential hazards in those facilities must complete additional safety documentation according to the facility hazard classification.

Additional safety analysis and documentation requirements that the PHS indicates for higher-hazard facilities include the following:

- Safety assessments for moderate-hazard nonnuclear facilities
- Safety analysis reports for high-hazard nonnuclear facilities and nuclear facilities
- Safety assessment documents for accelerator facilities

(Sandia National Laboratories, 1999)

For a complete list of documentation requirements at each hazard level, see Guth and Madigan (1998).

2.4 Developing and Implementing Controls

Establishment of the necessary programs and work controls that allow safe and efficient work management and execution involves identifying and formalizing the standards and requirements for performing work safely and establishing a contractual agreement between DOE and SNL for performing work. This function involves:

- Establishing procedures and permits for safe work management.
- Establishing ES&H support programs.
- Training and qualifying personnel.
- Other related activities.

The existing Sandia Management and Operating Contract (U.S. Department of Energy, 1994) serves as the authorization agreement for all SNL-wide work activities categorized as office hazard, standard industrial hazard, low-hazard nonnuclear, accelerator, and category 3 nuclear. The Sandia Management and Operating Contract and separate facility-specific authorization agreements serve as authorization agreements for category 2 nuclear facilities (Guth and Madigan, 1998). SNL/NM does not currently have any high-hazard nonnuclear or category 1 nuclear operations.

2.5 Performing Work

Performing the agreed-upon work in a safe and environmentally sound manner relies on management processes, procedures, and training. Performing work safely also requires readiness evaluations as indicated by the output of the PHS module of the ISMS Software. The hazard category determines the type of readiness evaluation and the participants:

- If the PHS indicates that a readiness assessment may be required for low-, moderate-, or high-hazard nonnuclear facilities, personnel who are familiar with the potential hazards in those facilities must:

- Contact a risk management specialist to determine applicability of readiness assessment requirements.
- Certify that the facility is ready to operate if readiness assessment requirements apply.
- Resolve all findings that result from a readiness assessment.
- If the PHS indicates that an accelerator readiness review may be required for an accelerator facility, personnel who are familiar with the potential hazards in those facilities must:
 - Contact a risk management specialist to determine applicability of accelerator readiness review requirements.
 - Certify that the facility is ready to operate if accelerator readiness review requirements apply.
 - Resolve all findings that result from an accelerator readiness review.
- If the PHS indicates that an operational readiness review may be required for nuclear facilities, personnel who are familiar with the potential hazards in those facilities must:
 - Contact a risk management specialist to determine applicability of operational readiness review requirements.
 - Certify that the facility is ready to operate if operational readiness review requirements apply.
 - Resolve all findings that result from an operational readiness review.

(Sandia National Laboratories, 1999)

Risk Management Program personnel conduct readiness reviews, accelerator reviews, and operational readiness reviews for SNL facilities (Mahn, 1997).

2.6 Obtaining Feedback and Improving

Continual assessment and improvement of ES&H performance includes SNL self-assessment activities and programs and processes necessary for monitoring and evaluating SNL's operating experience and performance.

Many sources of ES&H issues and concerns generate ES&H-related feedback, such as ES&H appraisals and audits, operating occurrences, root cause analyses, and ES&H performance trends. Several formal SNL processes and committees address ES&H issues and concerns and provide feedback to improve ES&H performance. These include quarterly corporate ES&H reports and quarterly evaluations of ES&H performance measures (Guth and Madigan, 1998).

3.0 ES&H CENTER (7500) INTERFACES, SUPPORT TEAMS, AND AUXILIARY GROUPS

3.1 Overview of Matrixed Interfaces

Three basic ES&H interfaces support SNL's core functions:

- ES&H departments within the ES&H Center (7500)
- Interdisciplinary ES&H support teams
- ES&H coordinators and councils

ES&H departments within the ES&H Center (7500) carry out defined roles within specific disciplines. The interdisciplinary ES&H support teams and other ES&H support functions, coordinators, and councils provide ES&H support in an efficient, coordinated manner that does not depend on contact and communication with a specific ES&H department. This allows a fluid and up-to-date dissemination of ES&H information throughout SNL and provides immediate support and feedback for any ES&H issues. In addition to ES&H support teams, the ES&H support functions or groups include the following:

- Division- and center-level ES&H coordinators
- Division- and center-level ES&H councils

- The Line Implementation Working Group
- Standing ES&H committees
- Management forums

The range of support provided by ES&H departments, ES&H support teams, and ES&H support functions includes:

- Communicating and interpreting ES&H requirements for implementing current regulations.
- Establishing ES&H performance monitoring and reporting systems.
- Ensuring that ES&H services are made known and available.
- Improving cost efficiency through waste minimization technologies.
- Conducting root-cause analysis and disseminating lessons learned.
- Addressing and resolving ES&H issues upon request.

3.2 ES&H Support Teams

The ES&H Center (7500) provides interdisciplinary ES&H support teams to assist SNL divisions in conducting their operations in a safe, healthful, and environmentally compliant manner. Each team contains subject matter experts with expertise in specific ES&H program areas, which makes each team a unit that can address ES&H issues and concerns related to the following:

- Industrial hygiene
- Radiation protection
- Environmental protection
- Waste management
- Safety engineering

3.3 ES&H Coordinators

ES&H coordinators are assigned at the division and center level by the division vice presidents and center directors as needed. They serve as an information resource to help centers and divisions ensure that work is performed safely for workers and the environment and that all applicable ES&H requirements are met. They provide a direct line of communication for all ES&H-related activities to line managers and staff. ES&H coordinators may:

- Serve as an interface between ES&H support organizations and their divisions or centers.
- Help establish ES&H performance monitoring and reporting systems for their divisions or centers.
- Serve as conduits for ES&H information flow to and from their divisions or centers.
- Help ensure appropriate implementation of ES&H processes, practices, and procedures and address any ES&H issues.
- Assist in root cause analyses and ensure that lessons learned are disseminated within their divisions or centers.

(Guth and Madigan, 1998)

3.4 ES&H Councils

Division vice presidents and center directors who have significant hazards within their workplaces may form ES&H councils to further promulgate ES&H management. A division ES&H council typically consists of the vice president (chair), the directors in the division, the division ES&H coordinator, and others as required. Center ES&H councils, where utilized, consist of the director, various department managers, and the center ES&H coordinator. An ES&H council may:

- Serve as a forum for discussion of ES&H issues within the division or center.
- Provide input to decisions made by vice presidents or directors.
- Set goals for ES&H programs within the division or center.
- Review progress in meeting goals.

- Review injuries, incidents, and reportable occurrences within the division or center.
- Ensure that lessons learned are disseminated within the division or center.

(Guth and Madigan, 1998)

3.5 Line Implementation Working Group

The Line Implementation Working Group consists of the following:

- All division ES&H coordinators
- Line Implementation Working Group chair from the ES&H Center (7500)
- Managers from the ES&H support organizations that supply customer ES&H support teams
- Ad hoc advisors as required

Some of the ES&H-related responsibilities of the Line Implementation Working Group are:

- Working with ES&H support organizations to ensure that ES&H processes and procedures are implemented.
- Reviewing portions of the *ES&H Manual*, supplements to the manual, and other ES&H documents before publication.
- Working with ES&H support organizations to identify and incorporate successful ES&H practices and lessons learned.
- Facilitating communication of ES&H information to line organizations.

(Guth and Madigan, 1998)

3.6 Standing ES&H Committees

Standing ES&H committees integrate new or special ES&H practices across the SNL organizational structure, and they are active only when needed. Examples include committees for radiation protection and union-management relations. These committees have formal charters that define their authority and how their outcomes are implemented (Guth and Madigan, 1998). See Sandia National Laboratories (1999), Section 1D, Attachment 1D-1, "Standing ES&H Committees," for a list of the committees and their purposes.

4.0 ENVIRONMENTAL PROTECTION PROGRAMS

4.1 Air Quality Program

The Air Quality Program is specifically concerned with three principal areas:

- Clean air network, which includes ambient air monitoring and surveillance, and meteorological monitoring
- Radiological National Emission Standards for Hazardous Air Pollutants (NESHAP) for existing, new, and modified sources of pollutants
- Air quality compliance reporting and permitting:
 - Hazardous chemical purchase inventory
 - Compliance reporting
 - Permitting compliance
 - *Clean Air Act* implementation
 - Control device assessment

The goal of the Air Quality Program is to assess and protect air quality at SNL/NM and nearby communities and to assist SNL organizations in complying with applicable environmental laws and regulations, particularly those for air quality permitting, reporting, and monitoring.

The objectives of the Air Quality Program are to:

- Keep SNL organizations, the public, and the DOE apprised of air quality issues.
- Train personnel in the proper management and control of emissions.
- Secure and maintain air quality permits and assist SNL organizations in achieving compliance with all permit requirements.
- Maintain an updated inventory of all regulated and potentially hazardous contaminants from SNL operations.
- Monitor ambient air quality and stack emissions (if required).
- Assess any applicable potential impacts of new and existing sources through emission testing, air sampling, or air modeling (if required).
- Maintain air quality compliance documents and records and ensure that all necessary reports are submitted to the appropriate agencies in a timely manner.

For more specific information on the Air Quality Program, refer to the following program documents:

- *Air Quality* (Sandia National Laboratories, 1997a)
- *ES&H Training Program* (Sandia National Laboratories, 1993a)
- *Environmental Monitoring and Surveillance Program* (Sandia National Laboratories, 1997c)
- *Facilities Asbestos Management* (Sandia National Laboratories, 1991e)
- *National Environmental Policy Act (NEPA)* (Sandia National Laboratories, 1991h)
- *ES&H Community Information and Participation Program* (Sandia National Laboratories, 1997d)
- *Pollution Prevention* (Sandia National Laboratories, 1991j)

(Sandia National Laboratories, 1997a)

4.2 Water Quality Program

The Water Quality Program is specifically concerned with the protection of water quality through the proper management of the following:

- Groundwater
- Storm water
- Wastewater
- Surface discharge
- Spill prevention control and countermeasures
- Underground storage tanks

The water quality processes of permitting, monitoring, and surveillance include several technical, legal, and administrative actions designed to meet the requirements and regulations that govern each of the water quality processes. These actions include public participation, training, and recordkeeping activities.

The goal of the Water Quality Program is to lead SNL in developing and implementing policies and procedures that assist SNL activities in complying with applicable federal, state, and local environmental laws, regulations, and DOE directives dealing with water quality.

The objectives of the Water Quality Program are to:

- Apprise SNL organizations, the public, and the DOE of water quality issues.
- Train personnel in proper management of discharges, runoff, spills, and leaks, and the proper application of safety and health procedures.
- Secure and maintain permits and notices of intent for surface discharge, sewer discharge, storm water runoff, and underground storage tanks.
- Perform storm water, wastewater, groundwater, surface discharge, spill prevention, and underground storage tank monitoring and surveillance.
- Sample and analyze discharges to verify compliance with all permits, notices of intent, and applicable regulations.
- Complete reporting and recordkeeping requirements.
- Prevent, detect, and remediate groundwater contamination

For more information about the specific aspects of the Water Quality Program, refer to the following program documents:

- *Water Quality* (Sandia National Laboratories, 1997h)
- *ES&H Training Program* (Sandia National Laboratories, 1993a)
- *Environmental Monitoring and Surveillance Program* (Sandia National Laboratories, 1997c)
- *Chemical Waste Management* (Sandia National Laboratories, 1991a)
- *Solid Waste Program* (Sandia National Laboratories, 1995d)
- *National Environmental Policy Act (NEPA)* (Sandia National Laboratories, 1991h)
- *ES&H Community Information and Participation Program* (Sandia National Laboratories, 1997d)
- *Pollution Prevention* (Sandia National Laboratories, 1991j)
- *PCB Inventory and Waste Disposal Program* (Sandia National Laboratories, 1995c)

(Sandia National Laboratories, 1997h)

4.3 Waste Management Program

The Waste Management Program is specifically concerned with the minimization of wastes and pollutants and the characterization, collection, packaging, storage, treatment, transportation, and disposal or recycling of the following waste categories:

- Radioactive
- Chemical
- Solid/sanitary
- Medical
- Asbestos
- Mixed
- Explosive
- Special case
- PCBs
- Classified

The waste handling processes of minimization, characterization, treatment, and storage or disposal include several technical, legal, and administrative actions designed to meet the requirements and regulations that govern each waste category. These actions include permitting, public participation, and training activities.

The goal of the Waste Management Program is to manage and dispose of waste generated by SNL operations in ways that are compliant with DOE directives and regulatory requirements, that reduce risks to the public and workers, and that protect the environment. The objectives of the waste management program are to:

- Collect, package, store, ship, and dispose of waste.
- Secure and maintain all necessary waste management permits.
- Train personnel in proper waste management practices and procedures.
- Inform the public of waste management issues and encourage public participation.
- Coordinate sampling and characterization of unknown or legacy waste.
- Motivate all SNL personnel to make environmental responsibility an integral part of their activities.

For more specific information on waste management and related topics, refer to the following program documents:

- *Waste Management* (Sandia National Laboratories, 1997g)
- *ES&H Training Program* (Sandia National Laboratories, 1993a)
- *Radioactive and Mixed Waste* (Sandia National Laboratories, 1991l)
- *Chemical Waste Management* (Sandia National Laboratories, 1991a)
- *Solid Waste Program* (Sandia National Laboratories, 1995d)
- *Medical Waste* (Sandia National Laboratories, 1996c)

- *National Environmental Policy Act (NEPA)* (Sandia National Laboratories, 1991h)
- *ES&H Community Information and Participation Program* (Sandia National Laboratories, 1997d)
- *PCB Inventory and Waste Disposal Program* (Sandia National Laboratories, 1995c)
- *Asbestos Waste Operations Management Program* (Sandia National Laboratories, 1995a)
- *Explosive Waste Program* (Sandia National Laboratories, 1995b)

(Sandia National Laboratories, 1997g)

4.4 Environmental Monitoring and Surveillance Program

The Environmental Monitoring and Surveillance Program is specifically concerned with two principal areas:

- Facility monitoring for air emissions and liquid effluents
- Environmental surveillance, including terrestrial and ecological
 - Ambient air monitoring
 - Meteorological monitoring
 - Preoperational assessments

The goal of the Environmental Monitoring and Surveillance Program is to manage emissions of pollutants (radioactive and hazardous chemicals) in a manner that preserves and protects the environment and public health. The objectives of the Environmental Monitoring and Surveillance Program are to:

- Conduct preoperational monitoring of new facilities and operations.
- Design and implement SNL's environmental monitoring plans for effluent monitoring and environmental surveillance.

- Establish an environmental data verification system to ensure the quality of all monitoring results.
- Report environmental occurrences and other required release reporting in accordance with regulatory guidance and requirements.
- Prepare annual site environmental reports.

For more information on the Environmental Monitoring and Surveillance Program, see Sandia National Laboratories (1996b; 1997c).

5.0 INDUSTRIAL HYGIENE PROGRAM

The role of the Industrial Hygiene Program is to help line organizations anticipate, identify, evaluate, and control potential health or injury hazards in the workplace that are the result of exposure to environmental stresses. These stresses generally fall into the categories of chemical, physical, biological, and ergonomic stresses.

Industrial Hygiene Program personnel are matrixed through the ES&H support teams and are responsible for interpreting all DOE directives and federal, state, and local regulations applicable to industrial hygiene and for developing programs that encompass these requirements. The Industrial Hygiene Program provides recommendations to SNL/NM organizations to achieve compliance; however, line managers and workers must implement the requirements (Sandia National Laboratories, 1997f; 1999).

Industrial Hygiene Program activities are categorized into the following areas:

- Chemical Protection Program areas:
 - Hazard communication
 - Carcinogen control
 - Reproductive toxins
 - *Toxic Substances Control Act*
 - Toxicology
 - Laboratory standard
 - Chemical inventory
 - SNL material safety data sheet development

- Physical Protection Program areas:
 - Noise/hearing conservation
 - Nonionizing radiation
 - Underwater diving
 - Heat/cold stress
 - Laser safety
- Biological Protection Program areas:
 - Food sanitation
 - Animal disease control
 - Bloodborne pathogens
 - Water quality
- Ergonomic Protection Program areas:
 - Chair fitting
 - Cumulative trauma disorders
 - Worksite evaluation
- Exposure Evaluation Program areas:
 - Sampling and monitoring
 - Sample analysis laboratory
 - Instrumentation
 - Occupational exposure assessment
- Controls and Personal Protective Equipment Program areas:
 - Respiratory protection
 - Confined space
 - Local exhaust ventilation
 - Emergency eyewash and showers
- Other areas:
 - Hazardous Waste Operations
 - Emergency Response
 - Records
 - Indoor Air Quality

(Yourick, 1997; Sandia National Laboratories, 1999)

For more information, see Sandia National Laboratories (1999), Chapter 6, "Industrial Hygiene," and *SNL/NM Industrial Hygiene Program* (Sandia National Laboratories, 1997f).

6.0 NUCLEAR SAFETY AND CRITICALITY PROGRAMS

Nuclear Safety and Criticality Programs at SNL include the following elements:

- Nuclear Safety Requirements Program
- Nuclear Facility Safety Program
- Nuclear Reactor Safety Program
- Nuclear Criticality Safety Program

The goal of SNL/NM's Nuclear Safety Requirements Program is to promote and protect the radiological health and safety of the public and workers at SNL/NM nuclear facilities and to protect the environment. Nuclear safety oversight is provided by departments within the ES&H Center (7500), the Nuclear Energy Technology Center (9300), and the Conduct of Operations/ES&H Center (14002). Additional oversight is provided by The Price-Anderson Amendments Act Review Committee, the Sandia Nuclear Criticality Safety Committee, and the Sandia Radiation Protection Safety Committee (Schmidt, 1997).

The objectives of the Nuclear Facility Safety Program are to ensure that:

- Nuclear facilities are sited, designed, constructed, modified, operated, maintained, and decommissioned according to uniform standards, guides, and codes.
- Radioactive and fissionable materials are produced, processed, stored, transferred, and handled such that the probability of an accident is within acceptable limits.
- ES&H matters receive an objective review, with risks reduced to acceptable low levels.
- Consideration is given to potential criticality hazards associated with fissionable material operations outside nuclear reactors.
- SNL property and operations are protected from the effects of potential accidents.
- Management authorization of operations is documented.
- SNL/NM is in compliance with applicable nuclear safety requirements.

(Sandia National Laboratories, 1991m)

The purpose of the Nuclear Reactor Safety Program is to establish reactor safety requirements for ensuring that:

- The safety of each SNL/NM reactor is properly analyzed, evaluated, documented, and approved by DOE.
- Nuclear facilities are sited, designed, constructed, modified, operated, maintained, and decommissioned in a manner that gives adequate protection for health and safety according to uniform standards, guides, and codes that are consistent with those applied to comparable reactors licensed by the Nuclear Regulatory Commission.
- The nuclear safety requirements described in the contract between DOE and Sandia Corporation are complied with and that a degree of care is exercised that is comparable to the risk involved.

(Sandia National Laboratories, 1991n)

The Criticality Safety Program provides guidance to SNL/NM managers and personnel in:

- Preventing or terminating an inadvertent criticality event.
- Mitigating the consequences of a criticality event.
- Protecting against personnel injury or facility damage.

(Sandia National Laboratories, 1998d)

For more information on nuclear safety at SNL/NM, see the following:

- *ES&H Manual* (Sandia National Laboratories, 1999) Chapter 18, Section G, "Reporting Nuclear Safety Rule Noncompliances"
- *Risk Management Requirements for Moderate- and High-Hazard Nonnuclear, Accelerator, and Nuclear Facilities* (Mahn, 1996b)
- *Safety of Nuclear Facilities* (Sandia National Laboratories, 1991m)
- *Safety of Nuclear Reactors* (Sandia National Laboratories, 1991n)

- *Nuclear Safety Requirements Program* (Schmidt, 1997)
 - *Nuclear Criticality Safety* (Sandia National Laboratories, 1998d)
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7.0 OCCUPATIONAL RADIATION PROTECTION PROGRAM

The goals of the SNL Occupational Radiation Protection Program are to:

- Prevent radiation exposure to workers without commensurate benefit.
- Control the accumulation of occupational radiation dose to levels below regulatory limits.
- Maintain occupational radiation dose as low as reasonably achievable below regulatory limits.
- Prevent the spread of radioactive contamination.
- Prevent the loss of control of radioactive material.

The objectives of the SNL Occupational Radiation Protection Program are:

- To provide documentation of the SNL Occupational Radiation Protection Program and approval of activities involving radiation, radioactive materials, or radiation-generating devices.
- To provide appropriate training to individuals who may be exposed to radiation or radioactive material.
- To adequately post and label areas, items, materials, and equipment that contain or may contain radiation or radioactive materials.
- To adequately establish access controls to areas that contain or may contain radiation or radioactive materials.
- To adequately control items, materials, and equipment that contain or may contain radiation or radioactive material.

- To adequately prepare for work with radiation, radioactive material, or radiation-generating devices.
- To adequately monitor and control the performance of work with radiation, radioactive material, or radiation-generating devices.
- To periodically and as necessary assess the adequacy of the SNL Radiation Protection Program and incorporate corrective actions and lessons learned.
- To adequately maintain records created by the SNL Radiation Protection Program and prepare all necessary reports.
- To adequately prepare for and respond to radiological accidents and emergencies.

(Miller, 1996)

For more detailed information on radiological protection at SNL/NM, see the following:

- *ES&H Manual* (Sandia National Laboratories, 1999)
- *SNL Radiation Protection Program, 10 CFR 835, Occupational Radiation Protection* (Miller, 1996)
- *Radiological Protection Procedures Manual* (Sandia National Laboratories, 1998e)

8.0 SAFETY ENGINEERING PROGRAMS

Safety engineering comprises the industrial and occupational safe and healthful practices for conducting work under potentially hazardous conditions. The focus of the program primarily concerns preventing bodily injury as a result of mechanical forces, explosions, electrical currents, or falls. Major activities of this program are providing consultation and guidance on safe work practices and required personal protective equipment, conducting safety appraisals of workplaces, assessing the safety of temporary modifications, reviewing ES&H SOPs, and investigating safety-related accidents and injury reports.

Specific safety engineering programs include:

- **Corporate Electrical Safety Program** - The Corporate Electrical Safety Program helps to ensure that electrical work and safety practices are performed in accordance with the *National Electrical Code* to minimize the risks to personnel associated with electrical hazards in the workplace. The primary duties are to provide guidance on issues concerning electrical safety and to work directly with the SNL Electrical Safety Committee.

- **Explosives Safety Program** - The Explosive Safety Program and the Sandia Explosives Safety Committee provides the following:
 - Consulting, review, and approval for all procedures involving explosives or devices that contain explosives

 - Equipment selection for use in areas where explosives are present

 - Personnel to serve as participants in explosives operations assessments

- **Firearms Safety Program** - The Firearms Safety Program prescribes the safe use, storage, and transportation of firearms and munitions used by SNL organizations and SNL Protective Force subcontractors. The program provides for the safety of security protective force personnel and for the protection of visitors and the public who may be affected by firearms operations. The Joint Firearms Safety Committee provides additional guidance for SNL activities that employ firearms. The program focuses on the following:
 - Safety training

 - Firearms range operations

 - Monitoring for noise, lead, and chemical exposures

 - Use of personal protective equipment

 - Exercises involving firearms

 - Storage and transportation of munitions

 - Review of operating procedures submitted to the Joint Firearms Safety Committee and safety analysis reports before approving implementation of any new operation, training, or exercises related to firearms

- **Lockout/Tagout Program for the Control of Hazardous Energy** - This program provides for the safety of personnel who perform work on or around energized equipment, processes, or systems at SNL. Out-of-service systems are locked and tagged before any work is performed that could result in injury or property damage if the equipment or system were unexpectedly reactivated or if stored energy were released. Safety engineering personnel provide information to SNL personnel on lockout/tagout requirements and lockout devices.
- **Material Handling Safety Program (cranes, hoists, and rigging)** - The Material Handling Safety Program controls all SNL operations involving cranes, hoists, rigging, below-the-hook lifting devices, and elevating work platforms to prevent potential injury and incidents involving personnel and equipment. The Hoisting & Rigging Safety Committee provides additional support. SNL personnel conduct specific equipment inspections and ensure maintenance, repairs, tests, and modifications are completed as required. Personnel also review equipment purchase requisitions and design drawing specifications for new crane, hoist, or rigging equipment to ensure that all safety considerations are met.
- **Pressure Safety Program** - The objective of the Pressure Safety Program is to provide SNL management and staff with oversight and design review for work involving pressure systems. The Pressure Safety Committee provides additional support to SNL organizations.
- **Other safety areas** - The Safety Engineering Program also communicates guidance and requirements for the following:
 - Ladder and scaffold safe practices
 - Walking and working surfaces
 - Forklifts and motorized hand trucks
 - Use of powered carts
 - Office safety
 - Machine and power tool safety program
 - Aviation safety
 - Working in high-injury-potential operations
 - Hot work safety
 - Fall prevention and fall protection
 - Signs, signals, and tags
 - Housekeeping
 - Personal protective equipment
 - Safety around excavations and trenches
 - Traffic safety

Safety engineering support comes from several organizations within the ES&H Center (7500).

For detailed information on safety engineering at SNL/NM, see the following:

- *Construction Environment, Safety and Health* (Sandia National Laboratories, 1991b)
 - *Corporate Electrical Safety* (Sandia National Laboratories, 1996a)
 - *Explosives Safety* (Sandia National Laboratories, 1991d)
 - *Firearms Safety Program* (Sandia National Laboratories, 1992)
 - *Machine and Power Tool Safety* (Sandia National Laboratories, 1991f)
 - *Lockout/Tagout Program for the Control of Hazardous Energy* (Sandia National Laboratories, 1993b)
 - *Material Handling* (Sandia National Laboratories, 1991g)
 - *Office Safety Program* (Sandia National Laboratories, 1991i)
 - *Pressure Safety* (Sandia National Laboratories, 1991k)
 - *ES&H Manual* (Sandia National Laboratories, 1999), Chapter 4, "Industrial Safety," and associated manual supplements and supplemental manuals
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9.0 CROSSCUTTING ES&H PROGRAMS

ES&H support activities cut across functional areas and organizational and program boundaries. This section identifies and describes these crosscutting ES&H programs. Other related ES&H functions are covered in Chapter 2, "Planning and Management of Assets at SNL/NM Facilities."

9.1 Emergency Preparedness and Response Program

SNL/NM's Emergency Preparedness Program ensures that SNL/NM is ready to respond appropriately to a variety of unplanned events. SNL/NM has sitewide emergency plans and procedures for the following:

- Activating the Incident Command System
- Operating the Emergency Operations Center
- Coordinating facility plans and emergency responses with other response organizations internal and external to SNL/NM

The most common facility emergencies are fires, hazardous material releases, and radiation releases. Natural emergencies likely at SNL/NM include severe weather.

Major aspects of this program include emergency preparedness and HazMat response.

For detailed information on the Emergency Preparedness and Response Program, see Sandia National Laboratories (1999), Chapter 15, "Emergency Preparedness," and Chapter 18, "Reporting, Investigating, and Correcting ES&H Events."

9.2 ES&H Oversight and Assessments

ES&H oversight helps to ensure that SNL conducts research and operates facilities in a safe and environmentally sound manner and in accordance with agreed-upon standards, requirements, and other clearly defined expectations. SNL's self-assessment processes are the foundation upon which SNL bases ES&H oversight, and they include three separate levels of self-assessment activities.

The first level consists of organizational self-assessments, which are conducted at the division level and below. They range from individual employees who review their own actions to more formal management surveillances and self-assessments. The scope, frequency, and rigor of organizational self-assessments are related to the hazards and risks (programmatic or ES&H) of their activities, the requirements of the *ES&H Manual*, and regulatory requirements. The primary drivers for establishing these assessment parameters are the managerial needs of both local and corporate management and the needs identified from the monitoring of performance indicators, which are continuously evaluated. Documentation of deficiencies and actions necessary to correct them are maintained by the self-assessing organization. Issues that require senior-level management action to correct, that may be of significance to other organizations, or that relate to compliance with requirements may be corporately reported and tracked.

The second level consists of functional program self-assessments, which focus primarily on the program elements of a functional area. When specific requirements or SNL priorities identify a

need, a review of line implementation aspects is included. Generally, functional program owners conduct functional program self-assessments to determine the status of program performance with regard to their responsibilities as program owners. Selection of functional self-assessments is dictated in part by a regulation or DOE directive, but other indicators and feedback are also taken into consideration when scheduling these assessments.

The third level consists of internal, independent ES&H assessments. These are objective evaluations of ES&H internal controls, including management practices and compliance with requirements, and they are performed by subject matter experts and assessors within the Audit Center (12800) who have no responsibility for the activities being assessed. These assessors help SNL senior management fulfill their oversight responsibilities by monitoring the adequacy, effectiveness, and performance of ES&H management systems and controls and by identifying and evaluating lab-wide systems issues related to ES&H. Formal appraisals from a system-level view of specific ES&H Program elements and of organizational implementation of ES&H provide comprehensive coverage on a periodic basis. Wherever practicable, these appraisals are integrated with other independent assessment functions (for example, financial, operational, information systems, and quality). Internal, independent ES&H appraisals may also be performed at the request of upper management, a functional program owner, or an organization (line) manager. In addition to formal appraisals, other less rigorous techniques such as surveying and monitoring are used to provide systematic and timely assessment of the ES&H aspect of SNL operations from the corporate viewpoint. Corporate-level assessment complements, supplements, and verifies self-assessments conducted in organizational (line) and functional program activities.

Assessment information is reviewed in detail twice a year for corporate operating experience/lessons learned, and DOE's Facility Representative Program provides confirmatory evidence.

SNL's current feedback and improvement documentation provides details about each of the assessment and oversight mechanisms. The SNL ES&H assessment program and associated guidance is currently documented through the following:

- *ES&H Manual* (Sandia National Laboratories, 1999), Chapter 22, "Feedback and Improvement Processes," and Chapter 2, Section 2F, "ES&H Inspections and Meetings"
- "Corporate ES&H Report" (Sandia National Laboratories, 1997b)
- "Laboratory Management Systems Policy" (Sandia National Laboratories, 1998c)
- *Performing and Documenting Management Surveillances* (Yesner, 1997)

DOE, Lockheed Martin, the Environmental Protection Agency (EPA), the Department of Transportation (DOT), and state and city agencies perform external assessments.

(Guth and Madigan, 1998)

9.3 ES&H Community Issues

The goal of the ES&H Community Issues Program is to create and maintain dialogues with local business, government, and civic organizations to manage issues of mutual concern and ensure public involvement. ES&H Community Issues personnel are responsible for disseminating information on ES&H projects to key audiences or to identify the proper spokesperson (Sandia National Laboratories, 1998g).

The Community Involvement and Issues Management Office is the primary coordinator for SNL's public involvement corporate process. As such, this office supports community dialogue on a variety of issues, which includes support to DOE in meeting public participation requirements for NEPA as requested by DOE. Recent examples of NEPA support include the sitewide environmental impact scoping meeting and numerous meetings for the Medical Isotope Production Program NEPA process.

The Community Involvement and Issues Management Office also serves as SNL's primary contact with local community (government and business) and public organizations. Working partnerships have been established with many departments within Albuquerque city government that have resulted in many cooperative projects, including the burn permit process and water conservation and pollution prevention. Numerous successful projects have also resulted from relationships established with the Bernalillo County Environment Department, the New Mexico Environment Department, and Isleta Pueblo. Memorandums of cooperation are close to being completed by SNL/NM, the City of Albuquerque, and Bernalillo County to continue these cooperative ventures.

The Community Involvement and Issues Management Office is also involved with the support of the DOE Citizens Advisory Board.

(Sandia National Laboratories, 1997d)

9.4 ES&H Concerns and Complaints

Primary activities of the ES&H Concerns and Complaints Program include protecting the rights of all SNL personnel to:

- Refrain from participating in any operations they believe to be unsafe to people or the environment until those operations have been evaluated and determined safe.
- Report unsafe conditions.
- Halt inappropriate operations they observe or in which they participate.

SNL is committed to ensuring that ES&H concerns are handled properly and that anyone reporting an ES&H concern at SNL receives timely evaluation and resolution of the concern and protection from reprimand, retaliation, or duress (Sandia National Laboratories, 1991c; 1999).

9.5 ES&H Performance Objectives and Performance Indicators Program

The ES&H Performance Objectives and Performance Indicators Program assists the ES&H Center (7500) and SNL/NM management and staff in maintaining compliance with ES&H laws, regulations, and DOE directives. SNL/NM has four corporate ES&H performance objectives:

- Protect the people
- Protect the environment
- Comply with regulations
- Use good management practices

To meet these performance objectives, the ES&H Performance Objectives and Performance Indicators Program monitors performance indicators outlined in *Corporate Milestones for Sandia National Laboratories* (Sandia National Laboratories, 1998b), the DOE/SNL annual appraisal agreement, and others, as necessary, to provide feedback for the ES&H Center (7500) (Sandia National Laboratories, 1998g).

9.6 ES&H Training Program

The ES&H Training Program provides the required ES&H training for SNL personnel. The focus is on educating SNL personnel to recognize and control hazards and their associated risks. ES&H Training Program personnel track the compliance status for required course completions and prepares a corporate compliance rollup report. ES&H courses include classes within the disciplines of safety engineering, industrial hygiene, emergency preparedness, fire protection, environmental protection, and radiation protection (Sandia National Laboratories, 1998g).

For detailed information on ES&H training, see the following:

- *ES&H Manual* (Sandia National Laboratories, 1999), Chapter 11, “ES&H Training”
- *ES&H Training Program* (Sandia National Laboratories, 1993a)
- *ES&H Training Catalog* (McCallaster, 1997)

9.7 Events Information Management Program

DOE O 232.1, *Occurrence Reporting and Processing of Operations Information*, establishes a DOE system for identification, categorization, notification, analysis, reporting, follow-up, and closeout of occurrences. Examples of occurrences include unplanned releases to the environment if the releases are over a specified volume or contain certain material. An occurrence can also be incurred as the result of an audit finding or other break in permit compliance or official agreement. In some cases, occurrences are reported to DOE and the State of New Mexico. DOE notifies appropriate agencies based on the nature of each occurrence. Events Information Management Program personnel track corrective actions for these events.

For detailed information on the Events Information Management Program, see Sandia National Laboratories (1999), Chapter 18, “Reporting, Investigating, and Correcting ES&H Events.”

9.8 Occupational Medicine Program

The Benefits and Health Services Center (3300) manages the Occupational Medicine Program. A key component of this program is medical surveillance (monitoring the health of employees who may be exposed to environmental hazards at or above the permissible standards), which provides assurance that all SNL/NM personnel working in hazardous facilities, in security positions, or on projects with a high potential for hazardous consequences are physically, emotionally, and mentally fit to perform their duties.

Specific baseline or periodic medical evaluations are required before personnel may participate in the following teams or perform the following jobs and job assignments:

- Accident Response Group
- Commercial drivers
- Cranes/hoists operators
- Asbestos abatement
- Confined space entry
- Emergency Reentry Team

- Environmental Restoration Group
- Hazardous Waste/HAZMAT Team
- Laser users
- Personnel Assurance Program
- Reactor and hot cell operators/supervisors
- Scuba divers (deep water)
- Security police officers at SNL/NM
- Foreign travel
- Incident Command System Team
- Nuclear Emergency Search Team
- Personnel Security Assurance Program
- Respirator users
- Scuba divers (surface-supplied)
- Other categories as determined by medical surveillance program personnel

(Sandia National Laboratories, 1999)

Other services provided by departments within Benefits and Health Services Center (3300) include the following:

- Consultation to ES&H professionals and return-to-work evaluations to employees who are returning to work after injuries or illnesses
- Injury prevention classes such as job-specific classes on lifting, back care, and video display terminal ergonomics
- Physical therapy
- Diagnostic, laboratory, and x-ray services
- Answers to questions from management regarding recommendations for accommodations and return-to-work issues
- Confidential maintenance of all medical records
- Coordination with the Safety Engineering Program to investigate all accidents and to take measures to prevent similar accidents

(Sandia National Laboratories, 1999)

For detailed information about the Medical Services Program, see Sandia National Laboratories (1999), Chapter 16, "Benefits and Medical Services," and Sanderville (1995).

9.9 National Environmental Policy Act Program

The *National Environmental Policy Act (NEPA)* is the basic national charter for protection of the environment that applies to federal facilities. NEPA compliance requires consideration of potential impacts related to all federal actions, programs, and projects.

The NEPA program operates under the direction of DOE/KAO and facilitates the NEPA process by fostering NEPA awareness, providing NEPA consultation to affected organizations, reviewing and assisting in the preparation of NEPA documents, tracking NEPA documents and determinations, and serving as the formal contact with DOE on all NEPA matters. The NEPA Compliance Team offers guidance through direct consultation and through specially developed NEPA guides that serve as a road map through the complex levels of NEPA regulation. SNL/NM NEPA records are submitted to the corporate ES&H records center for record management.

Although only DOE has authority to decide the appropriate level of NEPA documentation, SNL/NM assists DOE by drafting proposed documentation for DOE approval. The first step in the NEPA compliance process is to prepare a DOE environmental checklist/action description memorandum (ECL/ADM). Review by the NEPA Compliance Team may reveal that the proposed project has already been assessed as part of a previous DOE NEPA review. Most ECL/ADM forms are forwarded to DOE/KAO to determine the appropriate level of NEPA documentation for the project. Most SNL/NM projects are found to be categorically excluded under 10 CFR 1021, Appendices A and B to Subpart D.

Projects that are not categorically excluded may require preparation of an environmental assessment. An environmental assessment is required for all proposed actions that have the potential to significantly affect the quality of the human environment. Once the environmental assessment has been reviewed, a finding of no significant impact will be issued, or an environmental impact statement will be required. The environmental impact statement thoroughly documents the state of the environment in the vicinity of the proposed project, the likely impacts, and alternatives available to the original plan.

The NEPA Compliance Team works with many organizations within SNL/NM. The team also works with Facilities Business Unit personnel regarding U.S. Air Force use permits and maintains strong liaisons with the environmental restoration departments within the Geoscience and Energy Center (6100).

For more information, see Sandia National Laboratories (1999), Chapter 13, Section A, “NEPA, Sensitive Species, and Historic Properties,” and Sandia National Laboratories (1991h).

9.10 Packaging and Transportation Program

Aspects of the Packaging and Transportation Program include the following:

- Packaging and transportation safety
- Offsite shipment of hazardous material
- Onsite movement of hazardous material
- Vehicle and traffic safety

(Sandia National Laboratories, 1999)

For more information, see Sandia National Laboratories (1999), Chapter 12, “Packaging and Transportation of Hazardous Material,” and Sandia National Laboratories (1998a).

9.11 Risk Management Program

The goal of the Risk Management Program is to provide a process by which SNL/NM operations and activities are performed in a manner such that personnel, procedures, and hardware are effectively integrated and function within the boundaries of a measurable and controlled envelope of safe operation. The program uses a risk management process to systematically identify, analyze, document, and control circumstances that increase the likelihood and magnitude of negative consequences involving injury, death, damage, or loss. Risks are reduced as much as possible within the constraints of technical and operational effectiveness, cost, and time.

All SNL/NM organizations must implement the risk management process for existing or new facilities and changes to existing facilities. The process ends when a facility is decontaminated, decommissioned, and dismantled, or when the project, activity, or operation at the facility is completed.

Risk Management Program personnel act in an advisory role to facility owners, who are ultimately responsible for their own risk management. Specific functions include the following:

- Performing safety analyses of SNL/NM facilities and operations commensurate with the hazards present to provide assurance of operational safety
- Providing independent review of safety analysis documentation and the adequacy of facility safety as well as NEPA documentation

- Maintaining risk management databases that include the Primary Hazard Screening database
- Developing and maintaining appropriate risk management methods, implementing procedures, and guidance documents
- Interpreting requirements for safety documentation
- Providing programs, techniques, guidelines, and risk acceptance criteria for safety documentation
- Interfacing with DOE concerning safety documentation and NEPA documentation
- Integrating requirements information and databases
- Reviewing and providing quality assurance for SNL/NM organization safety and NEPA documents

Risk management documents provide the basis for DOE-required processes such as emergency planning. Risk management documents also provide the basis for evaluating any changes to a facility, equipment, procedures, and documentation to ensure that activities and operations are conducted within the safety envelope inherent in DOE's authorization.

Risk Management Program personnel also maintain the Startup and Restart Program, which defines SNL's corporate program for responding to the requirements of DOE 5480.31, *Startup and Restart of Nuclear Facilities*, and supplemental directive AL 5480.31, *Startup and Restart of AL Facilities*. The Startup and Restart Program includes two independent processes:

- Operational readiness review, which is a comprehensive verification that line management has achieved readiness to start up or restart a nuclear activity
- Readiness assessment, which is a comprehensive verification that line management has achieved readiness to start up or restart a nonnuclear activity or a nuclear activity involving an unreviewed safety question (USQ)

For information on the USQ Program, see *Implementing the Unreviewed Safety Question (USQ) Process for Nuclear Facilities* (Mahn, 1997).

See the following for detailed information about the Risk Management Program:

- *Risk Management* (Mahn, 1996a)
- *Risk Management Requirements for Moderate- and High-Hazard Nonnuclear, Accelerator, and Nuclear Facilities* (Mahn, 1996b)
- *ES&H Manual* (Sandia National Laboratories, 1999), Chapter 13, "Risk Management" and associated manual supplements

9.12 Other Crosscutting ES&H Programs

Other crosscutting ES&H programs include the Fire Protection Program and the Reapplication and Recycling Program. For more information on these programs, see Chapter 2, "Planning and Management of Assets at SNL/NM Facilities."

10.0 ES&H-RELATED PROGRAMS

An important program related to ES&H is the Environmental Restoration (ER) Project. The remediation of all past release sites at SNL/NM that are listed as ER sites is projected to be completed by the year 2001. A past release site is defined as an outdoor location at or below ground level that has or may have been contaminated as a result of operations. All potential sites discovered require further investigation to determine whether a site meets specific criteria for status as a solid waste management unit. Examples of past waste release sites include the following:

- Septic tanks and drainfields
- Inactive landfills
- Inactive firing sites
- Known spill sites
- Inactive sites that have soil that is stained or has a chemical odor

- Sites where there are buried containers or structures
- Sites at which soil surrounding an underground storage tank was not certified as clean when the tank was removed

The ER Project at SNL/NM is implemented by departments within the Geoscience and Environment Center (6100), whose responsibilities include the following:

- Management of the structure of the ER Project, including project planning, budgeting, oversight, compliance assurance, and coordination of all program interfaces related to internal contacts, DOE, regulatory agencies, and the public.
- Identification, assessment, and remediation of inactive waste sites and tracking of environmental site data in ER databases (all nonspatial data).
- Assurance of programmatic consistency in sample management operations and operation of the onsite chemistry laboratory.
- Support of ER field operations and development of technologies for site restoration.
- Management of the ER Geographical Information Service support and all ER spatial data by means of matrix arrangements. The ER site tracking coordinator maintains the official ER site list and the tracking database for potential ER sites.

The ER departments routinely work with organizations within the ES&H Center (7500).

(Fate, 1998)

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1.0 NOTABLE FACILITIES IN TECH AREA I

1.1 Introduction

SNL/NM's Tech Area I contains laboratories, shops, and office buildings used by administrative and technical staff for various activities, including the following:

- Administration
- Technical support
- Basic research
- Microelectronics
- Exploratory systems
- Business outreach
- Site support
- Component development
- Energy programs
- Defense programs
- Technology transfer

The information on Tech Area I facilities in this section is only as current and complete as the safety documentation upon which that information is based. In some cases, the sources of information for this section are out of date and incomplete, and the discussions of facilities in this section reflect those problems. Descriptions of facilities that have abundant safety documentation are developed more fully in this section than descriptions of facilities that, for one reason or another, do not have abundant documentation. (For example, the descriptions of chemical inventories for facilities that require offsite emergency planning is more complete than the descriptions of chemical inventories for facilities that do not require offsite emergency planning.) Though it results in unevenness in the level of detail throughout this section, each facility description is as complete as the supporting documentation will allow.

In all cases, the accuracy and completeness of the information on facilities in this chapter must be verified before that information is incorporated into the SNL/NM sitewide environmental impact statement.

1.2 6 MeV Tandem Van de Graaff Generator

This section provides an overview of the 6 MeV Tandem Van de Graaff Generator operations and operational safety analysis. A more complete discussion can be found in Walsh (1995), which was submitted to DOE in April 1995.

1.2.1 Purpose and Need

The mission of the 6 MeV Tandem Van de Graaff Generator is to provide advanced ion beam capabilities for materials research and development.

1.2.2 Facility Description

The 6 MeV Tandem Van de Graaff Generator, which is located in the Ion Beam Materials Research Laboratory in Building 884:

- Consists of a High Voltage Engineering EN model Van de Graaff accelerator and associated low-energy negative ion sources, beam lines, vacuum systems, and target chambers.
- Is an atomic particle accelerator with a maximum terminal potential of >7 MeV.
- Is capable of accelerating ions of most elements.
- Can achieve an ion velocity of ≤ 16 percent of the speed of light.
- Can achieve maximum particle energies of almost 60 MeV using multiple charge-state heavy ions (for example, Au^{+10}).

1.2.3 Program Activities

Because of an error, a survey of program managers regarding activities at notable facilities did not include the 6 MeV Tandem Van de Graaff Generator. However, at least some respondents listed activities for this facility when they listed activities at the Ion Beam Materials Research Laboratory, where the 6 MeV Tandem Van de Graaff Generator is located. See Section 1.8, "Ion Beam Materials Research Laboratory."

1.2.4 Summary of Operations

Experiments at the 6 MeV Tandem Van de Graaff Generator involve the analysis of exposure of materials to accelerated ion beams at stations in the accelerator target room.

The low-energy ion sources include a lithium exchange source for producing alpha particles, a cesium sputter source, and a direct-extraction proton source. Each source is associated with a

separate beam line that feeds into the low-energy end of the accelerator. The facility uses analyzer magnets at both the input and output ends to magnetically select the desired beam. This setup prevents errant atomic particle beams, which would be contained by the physical barrier that the beam tube vacuum system provides.

1.2.5 Description of Hazards and Hazard Controls

1.2.5.1 Offsite Hazards to the Public and the Environment

The 6 MeV Tandem Van de Graaff Generator contains only a small chemical inventory. Small amounts of chemical waste are disposed of through the SNL hazardous and chemical waste disposal processes.

Accidents at the facility present no hazards to the offsite public or the environment.

1.2.5.2 Onsite Hazards to the Environment

The 6 MeV Tandem Van de Graaff Generator presents no hazards to the onsite environment.

1.2.5.3 Onsite Hazards to Workers

The potential worker hazards at the 6 MeV Tandem Van de Graaff Generator include:

- Ionizing radiation, which the facility produces in small amounts in the form of x-rays, gamma rays, and neutrons. Small amounts of radioactive material are stored in a cabinet in Room 1E of the facility. The cabinet contains a very small total amount of radioactivity (<1 Ci) that is not in an easily releasable form. The radioactive materials in the cabinet include the following:
 - Sealed sources for energy calibration of various experiments.
 - Tritiated targets for calibration of neutron detectors using the T(d,n) reaction with deuterium accelerated by the 300-kV implanter in Room 1C of Building 884.
 - Fusion tokamak components that contain low levels of tritium.
- High-voltage electricity, including high-voltage power supplies, large capacitors, and the accelerator terminal itself.

- Insulating gases, including CO₂, N₂, and SF₆, which are used to electrically insulate the 6 MeV Tandem Van de Graaff Generator tank terminal. The CO₂ and SF₆ are supplied from commercial cylinders, and the N₂ is obtained from 100-l liquid N₂ dewars.
- Two small bottles of ammonia (total of 4 ft³), which are kept as a source gas to provide N beams for the accelerator.
- Confined spaces. (The 6 MeV Tandem Van de Graaff Generator tank constitutes a confined space during maintenance.)

1.2.5.4 Hazard Controls

Hazard controls at the 6 MeV Tandem Van de Graaff Generator include:

- Radiation shielding to protect personnel from gamma rays created in the 6 MeV Tandem Van de Graaff Generator tank. This shielding consists of lead that lines the wall common to the 6 MeV Tandem Van de Graaff Generator Vault (Room 1B) and Room 1A, Room 1C, Room 2, and Room 3 and that surrounds the terminal position on the outside surface of the 6 MeV Tandem Van de Graaff Generator tank. Solid concrete block walls shield the target and control rooms (Room 1D, Room 1E, and Room 1F) from each other and the vault.
- Access control. All entrances to the 6 MeV Tandem Van de Graaff Generator Vault (Room 1B) are automatically locked when any of the three ion sources is energized. These interlocks may also be activated at any time by a switch on the control console; however, the control console switch cannot turn off the interlocks when a source is energized.
- Operating procedures that:
 - Provide all critical steps for normal operations of the 6 MeV Tandem Van de Graaff Generator.
 - Describe the appropriate response to all potential facility accident conditions.
 - Describe administrative controls used to prevent or mitigate potential accidents (for example, radiation exposure during operation or confined space accidents during maintenance).

1.2.6 Accident Analysis Summary

1.2.6.1 Selection of Accidents Analyzed in Safety Documents

The facility hazards assessment document for the 6 MeV Tandem Van de Graaff Generator (see Thornton and Swihart, 1996) developed scenarios and estimated consequences for those chemical and radiological materials determined to be hazardous. Accidents similar to those evaluated for the accelerator facilities in Tech Area IV have not been evaluated for the Tandem Van de Graaff Facility (for example, electric shock, radiation exposure, fire, asphyxiation, natural phenomena events, and aircraft crash). The facility presents no potential for an airborne radioactive material release.

1.2.6.2 Analysis Methods and Assumptions

An assessment of the hazards of the 6 MeV Tandem Van de Graaff Generator is contained in Thornton and Swihart (1996). This document provides an evaluation of the chemical and radiological hazards in Building 884 as mandated by DOE 5500.3A.

1.2.6.3 Summary of Accident Analysis Results

The worst offsite event involved the release of 34 lb of ammonia under severe wind conditions. The actual health effects of this accident on the general public would be unnoticeable, and simple evacuation of facility personnel from within 150 m of the facility would negate any possible adverse health effects to workers.

1.2.7 Reportable Events

The 6 MeV Tandem Van de Graff Generator has had no reportable events over the past five years.

1.3 Photovoltaic Device Fabrication Laboratory

The summary of the Photovoltaic Device Fabrication Laboratory and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1993c), Starr (1995), and Bode (1998).

1.3.1 Purpose and Need

The Photovoltaic Device Fabrication Laboratory is used by engineers, scientists, and technicians to perform research to increase the cost effectiveness of solar cells.

1.3.2 Facility Description

The Photovoltaic Device Fabrication Laboratory is a low-hazard facility that occupies Room B (west) and Room C of Building 883, which is located within Tech Area I.

1.3.3 Program Activities

Table 4-1 shows the programs that use the Photovoltaic Device Fabrication Lab and their activities at the facility.

Table 4-1. Program Activities at the Photovoltaic Device Fabrication Lab

Program	Activities at the Photovoltaic Device Fabrication Lab
Advanced Manufacturing, Design and Production Technologies	Develop new processes and build prototypes.
Photovoltaics	Process silicon wafers into photovoltaic cells using standard semiconductor processing techniques.

(Sandia National Laboratories, 1997a)

1.3.4 Summary of Operations

Operations at the Photovoltaic Device Fabrication Laboratory include experiments to improve upon solar cell processing techniques, materials, and designs. Fabrication of photovoltaic devices involves the use of pressurized flammable gases during the fabrication process. Personnel perform diffusions into and oxidations of silicon wafers in a high-temperature, open-ended, quartz-tube furnace that brings silicon wafers up to temperatures between 350°C and 1,120°C in atmospheres of nitrogen, oxygen, argon, forming gas, and oxides of phosphorus and boron, which are formed by the oxidation of chlorine or bromine gases in the furnace tubes. An atmospheric-pressure chemical vapor deposition system (trade name Pyrox) is used for depositing films of silicon dioxide from the pyrolysis of silane and oxygen gases. Phosphine and diborane gases are also used when doping the oxide with phosphorus or boron, respectively.

A 30-W continuous wave and a 20-kW pulsed beam Nd:YAG Class IV laser, embedded in a Class I system, is used to scribe lines in and drill holes through silicon wafers.

1.3.5 Description of Hazards and Hazard Controls

Hazards at the Photovoltaic Device Fabrication Laboratory include the following:

- Laser hazards from a Rudolph Auto EL II IIIip Class II laser and a Class IV Nd:YAG pulsed scribing laser
- Potential electrical hazards from the following:
 - Dielectric evaporator
 - Laser power supply
 - Metal evaporator
 - Furnaces
 - Wet benches
 - Pyrox CVD
- Mechanical hazards from power tools, photoresist spinner, metal, and dielectric evaporator assemblies
- Thermal hazards from the following:
 - Convection oven
 - Diffusion furnaces
 - Liquid nitrogen
 - CVD
 - Hot plates
 - Vacuum oven
- Pressure hazards from compressed gas cylinders and supplied house nitrogen
- Environmental hazards from the following:
 - Acids, bases, and solvents from rinsing operations and the waste capture system
 - Ammonia gas from the vacuum oven
 - Chlorine and hydrogen chloride gas from furnace tubes
 - Cyanides and silver from plating solutions
 - Diborane from the manifold purge
 - Phosphine and silane from the manifold purge and the Pyrox vent

Administrative controls for these hazards include operating procedures, environment, safety, and health (ES&H) standard operating procedures (SOPs), and required and manager-specified ES&H training. For a list of these administrative controls, see Bode (1998).

Personnel at the Photovoltaic Device Fabrication Laboratory handle and use a wide variety of toxic and hazardous materials on a routine basis. Only qualified personnel use these materials, and various types of safety equipment prevent personal injury or damage. Examples of this equipment include the following:

- Automatic wet-bench fire extinguishers
- Vacuum-aspirated waste capture systems with overtemperature and overflow interlocks
- Exhaust failure alarms
- Splash shields
- Ventilated waste storage cabinets
- UL-approved chemical storage cabinets
- Spill kits
- Grounded solvent waste storage that is separated from ignition sources
- Spill trays under or within wet benches, chemical storage cabinets, and waste storage containers

Several redundant, automatic safety systems preclude the unintentional release of pressurized flammable gases into the work place or environment. These safety systems include toxic and flammable gas sensors that monitor continuously and that are connected to automatic gas cylinder shutoff valves and the building evacuation alarm. All hazardous gas cylinders have flow-limiting orifices to minimize the risk of uncontrolled release, and all conduits that transport gas, except for welded stainless-steel tubing, are housed in a ventilated enclosure that is protected by an exhaust failure alarm. Handling, usage, and cylinder replacement procedures for pressurized flammable gases are defined in a site-specific ES&H SOP. Operation of the Class IV laser is also covered by an ES&H SOP.

The Photovoltaic Device Fabrication Laboratory disposes of the majority of its liquid and solid wastes through the SNL waste management process. However, trace amounts of acids, bases, and solvents that cling to wafers are rinsed off with water. These amounts are estimated at approximately 20 ml per day. Amounts of approximately 10 ml per day are rinsed from empty chemical bottles before personnel dispose of the bottles.

The facility releases small amounts of hydride gases, the majority of which are burned when exhausted and pose no further hazard to health or to the environment. The amount of the material released is negligible and does not require an environmental permit.

1.3.6 Accident Analysis Summary

The Photovoltaic Device Fabrication Laboratory is a low-hazard nonnuclear facility and does not require accident analysis.

1.3.7 Reportable Events

Table 4-2 lists the only occurrence report for the Photovoltaic Device Fabrication Lab over the past five years.

Table 4-2. Occurrence Report for the Photovoltaic Device Fabrication Lab

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-6000-1993-0001	Unplanned Building Evacuation Due to Mixed Acid Spill	1B	The building was evacuated when hydrogen peroxide was accidentally added to an acid waste carboy, causing gas evolution.

1.4 Lightning Simulation Facility

The summary of the Lightning Simulation Facility and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1993b), Barnett (1994), and Holmes (1997).

1.4.1 Purpose and Need

The Lightning Simulation Laboratory generates simulated lightning to test nuclear weapon designs and safety-critical components for conformance to nuclear safety requirements. Other duties include:

- Supporting studies of the interaction of lightning with materials and structures.

- Testing electronic components, military missiles, aircraft, and communications equipment.

1.4.2 Facility Description

The Lightning Simulation Facility is in Building 888, which is a prefabricated, reinforced concrete structure that covers approximately 100 m². The facility includes the following:

- An office area
- A highbay
- A generator room, which houses a large motor/generator set
- A laser room
- A radio frequency induction-tight data acquisition support room
- An insulating oil pump and filter room
- A machine shop

The highbay houses a Marx generator and two 68,135-l tanks that are filled with transformer insulation oil during operation and that contain the Marx generator modules which provide the simulated lightning return-stroke currents. Each Marx generator contains numerous gas-filled SF₆ spark gaps and switches.

The laser room contains:

- A Class IV KrF pulsed laser for triggering electrical breakdown of a gas-filled switch inside the Marx generator.
- A Class II-B HeNe colinear continuous-wave laser for alignment of the pulsed laser.

The pump room contains the pumping and filtering equipment for transferring transformer oil to underground storage tanks when the facility is not in use.

The machine shop houses a lathe, a grinder, a band saw, a drill press, and a variety of hand power tools for fabricating test fixtures and maintaining the facility. The machine shop also contains electric arc and torch-type cutting and welding equipment.

1.4.3 Program Activities

Table 4-3 shows the programs that use the Lightning Simulation Facility and their activities at the facility.

Table 4-3. Program Activities at the Lightning Simulation Facility

Program	Activities at the Lightning Simulation Facility
Direct Stockpile Activities	Analyze safety and surety for nuclear weapons applications.
Performance Assessment Science and Technology	Simulate lightning strike environments on weapon systems and components.
Nuclear Energy Research and Development	Evaluate electrical cable performance and develop condition monitoring techniques.
Sustaining Critical Progress in Model Validation	Validate EM code development.

(Sandia National Laboratories, 1997a)

1.4.4 Summary of Operations

Personnel at the Lightning Simulation Facility subject test objects to severe simulated lightning currents. The facility can produce multiple-stroke and continuing-current components separately or combined in a single test event.

Four Marx banks generate the return-stroke output current, and the banks can be independently configured to provide one or two return strokes. The maximum output of each bank is 1.6 MV. The facility can produce fast-rise, long-decay, unipolar return-stroke currents or continuing currents, which the large motor-generator provides by spinning up in the motor mode to a designated speed and then switching to generator mode at the initiation of the test shot.

In the testing process, test objects are either hand-carried or moved through a large door by truck before personnel prepare the test object for testing. These preparations may include machining and fabricating test fixtures for the experiment. The transformer insulation tanks are filled and the test object is positioned and secured before the object is exposed to simulated lightning. Following the test, personnel drain the transformer insulation oil tanks and return the test object to its owner.

1.4.5 Description of Hazards and Hazard Controls

Hazards at the Lightning Simulation Facility include the following:

- Electrical, confined space, and noncommercial equipment hazards presented by the Marx generators
- Electrical hazards from the CCG room, gas cabinet interlocks, mini-Marx generators, and the Marx trigger
- Mechanical hazards from a 6-ton overhead hoist, which presents danger from falling objects, and an electrical generator, which has a spinning flywheel
- Pressure hazards from standard DOT gas cylinders
- Environmental hazards from solvents and routine chemical and from two underground storage tanks that each contains 30,000 gal of oil

Lightning simulation testing is in itself a nonroutine industrial hazard. Several precautions and ES&H SOPs have been implemented to prevent personnel injury or property damage. Facility personnel are required to take ES&H training courses for the hazards that the facility presents.

A personnel accountability system utilizes control badges and a physical head count prior to arming and firing to ensure that personnel are in a safe location during system testing.

A quantity of 500 l of 5 percent fluorine and 95 percent helium gas for laser operation is in a DOT-approved cylinder in the laser room. The cylinder is stored in a cabinet equipped with a continuously running exhaust system. ES&H SOPs govern all laser operations.

Operations involving the use of insulating oil are covered in an ES&H SOP. Other chemicals and material used at the Lightning Simulation Facility include the following:

- Solder flux (1 quart)
- Machining fluids (1 pint)
- Lubricating fluids (1 pint)
- General purpose cleaner (20 fluid ounces)
- Copper sulfate (5 gal)

1.4.6 Accident Analysis Summary

The Lightning Simulation Facility is a low-hazard nonnuclear facility and does not require accident analysis.

1.4.7 Reportable Events

Table 4-4 lists the only occurrence report for the Lightning Simulation Facility over the past five years.

Table 4-4. Occurrence Report for the Lightning Simulation Facility

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-9000-1998-0002	Technician Receives Electrical Shock During Maintenance Operation	10C	An employee received an electrical shock while troubleshooting a Mini-Marx generator.

1.5 Energy and Environment Facility

1.5.1 Purpose and Need

The Energy and Environment Facility provides offices and laboratory space for a variety of energy-related and material science research programs.

1.5.2 Facility Description

The Energy and Environment Facility is in Building 823, which is a 144,581-ft² building that was built and occupied in 1982. The building is constructed of structural concrete with stucco exterior walls and a flat, built-up roof, and it has four stories, a full basement, and a mechanical penthouse.

The following laboratories and test facilities in Building 823 are operated by the Materials & Process Sciences Center (1800) and have one or more activities that have been classified as low-hazard activities by SNL's primary hazard screening process.

- Process Unit Facility
- Catalyst Development Laboratory
- Fuel Cell Development Laboratory
- Materials Synthesis Laboratory
- Instrumental Analysis Laboratory
- MicroFlow Reactor Test Laboratory

- Feedstocks Process Chemistry Lab
- Catalysis Research Analytic Lab
- Materials Science Lab
- Process Research and Catalyst Evaluation Lab
- Batch Microautoclave Test Facility
- Nano-Sized Materials Synthesis Lab
- Surface Science Laboratory

The following are other low-hazard laboratories and test facilities in Building 823 that are operated by various organizations within the Physical Sciences and Components Division (1000) and the Energy, Information, and Infrastructure Technology Division (6000):

- Geophysics Lab
- Light Electronics Lab
- Thermal Properties Testing Laboratory
- Soil-Actinide-Metal Interactions Analysis and Modeling Laboratory
- Geotechnology Research Lab
- Geophysical Instrumentation Laboratory
- Chemistry Laboratory for Department 6216
- Seismic Instrumentation Laboratory
- Process Analytical Chemistry Lab

The following facilities in Building 823 have been classified as those that contain standard industrial hazards:

- Light Laboratory Operations
- Water Chemistry Laboratory
- UHV Interfacial Force Microscopy Laboratory
- Wind Turbine Test Apparatus
- Colloid and Sorption Chemistry Lab
- Geochemistry Labs for Department 6118
- Langmuir Blodgett Film Laboratory

The following facilities and activities in Building 823 have been classified as business occupancies:

- Nuclear Waste Management Office
- Department 6216 Offices
- Center 6100 Offices

- Division 6000 Offices
- Studies and Analysis for Nuclear Regulatory Commission
- Market Hub Partners

1.5.3 Program Activities

Table 4-5 shows the programs that use the Energy and Environment Facility based on an SNL survey of program use of major facilities. A survey of program managers did not identify all of the specific programs that use the various laboratories and test facilities; additional details can be obtained by contacting the various technical experts who operate and maintain the facilities and activities listed in Section 1.5.2, "Facility Description."

Table 4-5. Program Activities at the Energy and Environment Facility

Program	Activities at the Energy and Environment Facility
Catalysis and Separations Science and Engineering	Develop and test catalysts and separations materials, processes, and devices.
Coal Conversions	Develop catalysts and materials and research processes.

(Sandia National Laboratories, 1997a)

1.5.4 Summary of Operations

Building 823 contains a large number of specific operations associated with a wide variety of laboratory equipment such as spectrometers, laser fluorescence systems, tube furnaces, atomic absorption units, vacuum ovens, other small furnaces, and calorimeters. Storage and handling of chemicals and use of and electrical equipment is involved in various laboratory operations. Details on specific laboratories and operations can be obtained from primary hazards screening reports and by contacting the various technical experts who operate and maintain the facilities and activities listed in Section 1.5.2, "Facility Description."

1.5.5 Description of Hazards and Hazard Controls

Typical hazards in Building 823 including those associated with chemicals, lasers, and electrical and mechanical operations in laboratory and industrial environments. Additional details can be obtained from primary hazards screening reports. Hazard controls are in place per applicable DOE directives and other safety standards.

1.5.6 Accident Analysis Summary

All activities and operations at the Energy and Environment Facility are classified by SNL's primary hazard screening process as low-hazard nonnuclear, standard industrial hazard, or business occupancies. Accordingly, no activity or operation within the facility requires accident analysis.

1.5.7 Reportable Events

Table 4-6 lists the occurrences at the Energy and Environment Facility over the past five years.

Table 4-6. Occurrence Reports for the Energy and Environment Facility

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-NMFAC-1993-0014	Unplanned Building Evacuation Due to a Burned Out Electrical Motor	1H	The building was evacuated when an occupant detected a burning odor from a burned out electrical motor.
ALO-KO-SNL-6000-1997-0007	Loss of Accountability of a Sealed Source	1D	A tritium source was found not to be registered with SNL's source registrar.

1.6 Compound Semiconductor Research Lab

The summary of the Compound Semiconductor Research Lab and its operations, hazards, and hazard controls is drawn from Walker (1997a) and Sergeant (1997).

1.6.1 Purpose and Need

The mission of the Compound Semiconductor Research Lab is to investigate the physics of compound semiconductors and device structures.

1.6.2 Facility Description

The Compound Semiconductor Research Lab is in Building 893, which is an 11,852-m², single-story building with an equipment penthouse on the roof. The building is constructed with a concrete slab foundation, concrete masonry unit exterior walls, concrete columns and beams as the primary roof support, masonry unit exterior walls and wallboard interior walls, concrete and tile floors, suspended acoustical ceiling, and a bar joist/metal deck, hypalon fabric roof.

Current planning calls for combining the existing capabilities of the Compound Semiconductor Research Lab with elements of the Microelectronics Development Laboratory (MDL) into several new facilities that would be called the Microsystems Engineering Science Applications (MESA) Complex facility proposed for the FY2000-2003 timeframe. Additional discussion on the MESA Complex is provided in Chapter 7.0, "Microelectronics Development Laboratory Source Information" "2.0 Purpose and Need," and "5.0, Operations and Capabilities."

1.6.3 Program Activities

Table 4-7 shows the programs that use the Compound Semiconductor Research Lab and their activities at the facility.

Table 4-7. Program Activities at the Compound Semiconductor Research Lab

Program	Activities at the Compound Semiconductor Research Lab
Direct Stockpile Activities	Research and develop microelectronic devices for nuclear weapon applications.
System Components Science and Technology	Fabricate microelectronic and photonic devices based on compound semiconductors. Study and refine techniques for processing compound semiconductors.
Technology Transfer and Education	Develop processes in conjunction with industry partners.
Advanced Manufacturing, Design and Production Technologies	Develop new processes and build prototypes.
Materials Sciences	Fabricate new, artificially structured materials through advanced growth or processing techniques.
Atmospheric Radiation Measurement	Fabricate microchannels, integrated micro-optics, and other sensors.

(Sandia National Laboratories, 1997a)

1.6.4 Summary of Operations

The Compound Semiconductor Research Lab is used to investigate the physics of compound semiconductors and device structures. The facility also supports the fabrication of optoelectronic and digital compound semiconductor devices for both research and prototyping purposes.

1.6.5 Description of Hazards and Hazard Controls

Table 4-8 summarizes the hazardous material in the Compound Semiconductor Research Lab.

**Table 4-8. Compound Semiconductor Research Lab
Hazardous Material Summary**

Chemical	Maximum Quantity
Ammonia	13.4 ft ³
Ammonia, anhydrous	140 lb
Arsine, 100%	100 lb
Boron trichloride	10 lb
Boron trifluoride	35 g
Chlorine	7 lb
Hydrochloric acid, 37%	15 liters
Hydrofluoric acid, 49%	11.3 liters
Hydrogen selenide, 100 ppm	500 g/ft ³
Phosphine, 100%	100 lb
Silane	1020 g
Silicon tetrafluoride	1 lb
Sulfur dioxide	100 g

The following gases are stored in DOT-approved cylinders:

- Ammonia
- Boron trifluoride
- Silane
- Sulfur dioxide
- Boron trichloride
- Chlorine
- Silicon tetrafluoride

The arsine and the phosphine are stored in specially designed stainless steel tanks of limited capacity equipped with passive restrictive orifices inside the valves that reduce the rate of escape.

The DOT-approved cylinders and the specially designed tanks are housed in commercial gas cabinets that are equipped with the following:

- Automatic or manual gas purge controllers
- Excess-flow or overpressure shutoff

- Automatic shutoff in event of toxic gas detection or fire alarm
- Remote automatic shutoff
- Continuous exhaust
- Continuous monitoring

The hydrochloric acid and hydrofluoric acid are kept in plastic bottles that are stored in vented chemical storage cabinets equipped with spill trays.

Environmental hazards at the Compound Semiconductor Research Laboratory include the following:

- Acids
- Bases and caustics
- Oils
- Oxidizers
- Toxics
- Fluorescent bulbs
- Solvents

Administrative controls, including ES&H training, ES&H standard operating procedures, and equipment-specific operating procedures are in place for the hazards at the Compound Semiconductor Research Laboratory. For a complete list of hazards and hazard controls at the facility, see Sergeant (1997).

1.6.6 Accident Analysis Summary

The Compound Semiconductor Research Lab is a low-hazard nonnuclear facility and does not require accident analysis.

1.6.7 Reportable Events

Table 4-9 lists the occurrence reports for the Compound Semiconductor Research Lab over the past five years.

Table 4-9. Occurrence Reports for the Compound Semiconductor Research Lab

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-1000-1993-0002	Toxic Gas Alarm	1H	An alarm sounded due to a 30-second release of phosphine.
ALO-KO-SNL-1000-1994-0001	Facility Evacuation/False Toxic Alarm	1H	An alarm sounded after contact with leaking water from a cooling coil.
ALO-KO-SNL-NMSEC-1997-0003	Protective Force Officer Inadvertently Left Perimeter Gate Unsecured and Unattended	10C	The gate was unattended while the officer provided key service to an authorized employee.

1.7 Power Development Laboratory

The summary of the Power Development Laboratory and its operations, hazards, and hazard controls is drawn from Walker (1997b) and from primary hazard screenings of individual laboratories.

1.7.1 Purpose and Need

The Power Development Laboratory serves as a research and development facility for the design, development, and prototyping of thermal and lithium batteries.

1.7.2 Facility Description

The Power Development Laboratory is primarily located in Building 894, which is an 8,974-m², two-story building with a mezzanine. The building is constructed of a concrete slab foundation, concrete brick, stucco exterior walls, and a built-up roof.

The facility contains the following laboratories and buildings:

- Lithium Ambient Battery Fabrication Laboratory (Room 131-B)
- Materials Processing Laboratory (Room 133-3B)
- Thermal Battery Test Laboratory (Room 136)
- Electrochemical Research Laboratory (Room 134-C)
- Thermal Battery Research Laboratory (Room 136-C)

- Ambient Battery Test Laboratory (Room 130)
- Chemical Laboratory (Room 138-C2)
- Microscopy Laboratory (Room 139C)
- Chemical Storage Building (approximately 20 meters west of Building 894)

1.7.3 Program Activities

Table 4-10 shows the programs that use the Power Development Laboratory and their activities at the facility.

Table 4-10. Program Activities at the Power Development Laboratory

Program	Activities at the Power Development Laboratory
System Components Science and Technology	Develop, test, and produce power sources (batteries).
Production Support and Capability Assurance	Develop and produce backup supply of thermal batteries.
Advanced Manufacturing, Design and Production Technologies	Develop new processes and build prototypes.
Energy Storage Systems	Development of energy storage systems.

(Sandia National Laboratories, 1997a)

1.7.4 Summary of Operations

The following summarizes operations at the Power Development Laboratory by individual laboratories:

- Activities at the Thermal Battery Test Laboratory include:
 - Fabrication and testing of thermal battery cells and modules.
 - Synthesis of inorganic compounds.
 - Testing the sensitivity of heat pellets with a portable laser.

- Use of an argon gas thermocouple welder.
- Activities at the Electrochemical Research Laboratory include:
 - Building, filling, and evaluating the performance of small, ambient temperature cells and batteries (including lithium batteries).
 - Dissection and analysis of components.
 - Preparation of electrolytes and various chemical formulations for use in batteries, supercapacitors, and other electrochemical devices.
 - Characterization of materials.
 - General chemistry activities.
- Activities at the Thermal Battery Research Laboratory include:
 - Testing of single battery cells in the glove box.
 - Occasional testing of thermal batteries.
 - Differential scanning calorimetry.
- Activities at the Chemical Laboratory include:
 - General chemistry for the battery research departments.
 - Bromine complexing studies and electrolyte preparation, which are conducted in the fume hood under the direction of the project manager.
- Activities at the Materials Processing Laboratory include high-temperature processing of and ball milling of materials.
- Activities at the Ambient Battery Test Laboratory include performance characterization of cells.
- Activities at the Microscopy Laboratory include scanning electron microscopy of materials.

1.7.5 Description of Hazards and Hazard Controls

Hazards at the Lithium Ambient Battery Fabrication Laboratory include the following:

- Mechanical hazards from the Reliable roller and Wabash press
- Thermal hazards from furnaces
- Pressure hazards from gas cylinders
- Environmental hazards from:
 - Carbon black
 - Lithium batteries and associated materials
 - Lithium foil
 - Vacuum pump oil

For a list of administrative controls for the hazards at the Lithium Ambient Battery Fabrication Laboratory, see Weigand (1997).

Hazards at the Thermal Battery Test Laboratory include the following:

- Potential electrical hazards from:
 - Alkaline batteries
 - Double-layer capacitors
 - Power source testers
 - Capacitor discharge unit
 - Lead/acid batteries
 - Thermal batteries
- Thermal hazards from temperature chambers
- Environmental hazards from solders and vented thermal batteries

For a list of administrative controls for the hazards at the Thermal Battery Test Laboratory, see Herrera (1997).

Hazards at the Electrochemical Research Laboratory include the following:

- Thermal hazards from:
 - Butane torches
 - Hot plates
 - Liquid nitrogen
 - Ovens
- Environmental hazards from:
 - Carbon
 - Diethylene carbonate
 - Dilute H₂SO₄
 - Dilute HCl
 - Oxides
 - Propylene carbonate
 - Other chemicals

For a list of the administrative controls for the hazards at the Electrochemical Research Laboratory, see Ingersoll (1997).

Hazards at the Thermal Battery Research Laboratory include the following:

- Potential electrical hazards from batteries
- Mechanical hazards from a vacuum pump
- Thermal hazards from liquid nitrogen and platen heaters
- Pressure hazards from gas cylinders
- Environmental hazards from:
 - Argon
 - Hydrogen

- Vacuum pump oil

For a list of the administrative controls for the hazards at the Thermal Battery Research Laboratory, see Reinhardt (1997).

Hazards at the Chemical Laboratory include thermal hazards from hot plates and environmental hazards from sulfuric acid and wipes and gloves that are contaminated with electrolyte. For a list of administrative controls for the hazards at the Chemical Laboratory, see Jimenez (1997).

Hazards at the Materials Processing Laboratory include gas cylinders and thermal hazards from cylinders; hazards at the Microscopy Laboratory include thermal hazards from liquid nitrogen; and hazards at the Ambient Battery Test Facility include electrical hazards from test equipment and batteries and thermal hazards from ovens.

Table 4-11 summarizes the hazardous material inventory at the Power Development Laboratory.

Table 4-11. Power Development Laboratory Hazardous Material Summary

Chemical	Maximum Quantity	Location
Bromine	50 ml	Room 134-C
	50 ml	Room 133G
Carbon disulfide	500 g	Room 133-G
	1.43 l	Chemical Storage Building
Hydrobromic acid (48.5%)	500 ml	Room 138-C2
Lead powder	1.36 kg	Room 155
Lithium tetrachloroaluminate in thionyl chloride	10 l	Room 131-B
Lithium tetrachloroaluminate in thionyl chloride	20 l	Chemical Storage Building
Nickel powder	700 g	Room 132-G
Nitric acid (71%)	3 l	Room 131-B
	1,500 ml	Room 134-C
	1,500 ml	Room 153
Thionyl chloride	4 l	Room 131-B
	9 l	Chemical Storage Building
	4,000 ml	
	10 l	

The radiological hazards in Building 894 fall below the screening criteria in 10 CFR 30.72.

The following summarizes hazard controls for hazardous material at the Power Development Laboratory:

- Lithium tetrachloroaluminate in thionyl chloride is stored at ambient temperature and pressure in 1-l glass bottles that are kept in flammable material storage cabinets with adequate secondary containment. Lithium tetrachloroaluminate in thionyl chloride is used in negative-pressure gloveboxes.
- Nitric acid is stored at ambient temperature and pressure in 500-ml glass bottles that are kept in flammable material storage cabinets with adequate secondary containment.
- Thionyl chloride is stored at ambient temperature and pressure in 500-ml glass bottles that are kept in glove boxes with adequate secondary containment. Thionyl chloride is used in glove boxes that are vented through scrubbers and a charcoal filter.

1.7.6 Accident Analysis Summary

The Power Development Laboratory is a low-hazard nonnuclear facility and does not require accident analysis.

1.7.7 Reportable Events

Table 4-12 lists the occurrence reports for the Power Development Laboratory over the past five years.

Table 4-12. Occurrence Reports for the Power Development Laboratory

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-2000-1993-006	Radiation Source Found in Uncontrolled Area	1D and 1F	A pig that held a 1-mCi Pu-239 radiation source was found in an uncontrolled area.
ALO-KO-SNL-1000-1998-0002	Overpressurization and Venting of Battery Results in Personnel Injury	3A	A worker received first and second degree burns to his hands and a cut to his finger when he loaded a battery into a test fixture that had vented due to overpressurization.

1.8 Ion Beam Materials Research Laboratory

The summary of the Ion Beam Materials Research Laboratory and its operations, hazards, and hazard controls is drawn from Thornton and Swihart (1996).

1.8.1 Purpose and Need

The mission of the Ion Beam Materials Research Laboratory is to perform basic and applied research and to establish theories and models in the areas of materials science, solid-state physics, and accelerator physics. The work of the Ion Beam Materials Research Laboratory supports research and development for Defense Programs, Energy and Environment Programs, and work for others through lab-directed research and development and cooperative research and development agreements.

1.8.2 Facility Description

The Ion Beam Materials Research Laboratory is located in Building 884, which is built on a concrete slab with structural steel framing covered with corrugated metal siding and roof. Building 884 is a single-level structure of approximately 1,309 m², which includes a 100-m² addition that was completed in the first quarter of 1995.

Major equipment in the facility includes two Van de Graaff accelerators and a 400-kV ion implanter.

The Ion Beam Materials Research Laboratory includes several major supporting laboratories:

- Ion Implantation Physics Lab
- Electron Cyclotron Resonance Lab
- Ion Implantation and Ion Beam Analysis Lab
- Double Crystal Diffractometry Lab
- Materials Modification Lab

1.8.3 Program Activities

Table 4-13 shows the programs that use the Ion Beam Materials Research Laboratory and their activities at the facility.

Table 4-13. Program Activities at the Ion Beam Materials Research Laboratory

Program	Activities at the Ion Beam Materials Research Laboratory
Performance Assessment Science and Technology	Study fundamental ion beam materials interactions. Develop processes involving use of ion beams to produce novel engineered materials.
Magnetic Fusion	Ion beam analysis of material composition for test articles obtained from other parts of the program.
Materials Sciences	Use of energetic ion beams to understand new opportunities to tailor material properties through radiation modification and to investigate new materials to understand the underlying science of the behavior of materials.

(Sandia National Laboratories, 1997a)

1.8.4 Summary of Operations

Operations in the Ion Beam Materials Research Laboratory involve:

- Rutherford backscattering spectrometry for compositional and depth profiling of materials, generally with a helium ion beam of 1 MeV to 3 MeV energy. High-energy beams of up to 10 MeV are used to help profile lighter elements in a heavy element substrate.
- Heavy-ion backscattering spectrometry (low-energy, heavy-ion analysis beam) to measure extremely low levels of heavy impurities on light substrates such as silicon wafers.
- Elastic recoil detection using a high-energy, heavy-ion beam to recoil (knock) light elements from a target, which enables the profiling of very light elements such as hydrogen.
- Time-of-flight elastic recoil detection using a time-of-flight detector to achieve high depth resolution and permit the separation of various isotopes of the element of interest.
- Ion channeling to probe atomic structure of a material in the near surface, allowing the depth profiling of defects and strain.
- External ion beam analysis on a variety of materials that cannot be placed in a vacuum system.
- Ion microtomography to nondestructively measure three-dimensional density variations within samples with microscale resolution.

- Coulomb excitation for quantitative isotopic analysis of materials at 100-ppm sensitivity levels.
- Accelerator mass spectrometry to determine atomic and molecular abundances with high throughput and 1 percent accuracy.
- Quantitative elemental analysis using particle-induced x-ray emissions with detection sensitivities down to 1 μg per g to produce three-dimensional elemental distribution maps.

The following summarizes operations at the major supporting laboratories:

- The Ion Implantation Physics Lab includes a keV ion accelerator and an MeV ion accelerator. Scientists and technicians use the keV ion accelerator experimentally to determine the effects of ion beam irradiation and implantation on material properties and for low-energy ion beam analysis. The MeV ion accelerator is used to analyze materials using various ion beam techniques.
- The Electron Cyclotron Resonance Lab is used to experimentally determine the use of low-energy ions (less than 300 eV) for plasma deposition and growth of thin film materials.
- The Ion Implantation and Ion Beam Analysis Lab is used primarily to study the crystal quality and strains present in single crystals and thin-layer or multilayer samples.
- Scientists and technicians in the Materials Modification Lab use three furnace systems for sample material modifications:
 - The Line Source Electron Beam System is used to treat samples with a controlled, rapid, thermal annealing cycle, which is accomplished by sweeping a sample through an electron beam.
 - The Pulsed Laser Deposition System is used to laser abate and deposit thin layers of target material onto a sample.
 - The Controlled-Atmosphere High-Temperature System is used to vacuum anneal (up to 1,000°C) a variety of samples necessary for material science and solid-state physics research.

1.8.5 Description of Hazards and Hazard Controls

Hazardous material at the Ion Beam Materials Research Laboratory includes 34 lb of ammonia, which is stored in a wall-mounted, standard gas cylinder in Room 2 of Building 884. Use and handling of this material is according to approved ES&H SOPs.

Radiological sources at the Ion Beam Materials Research Laboratory are below the screening thresholds of 10 CFR 30.72 or are nondispersable sealed sources.

Hazard controls at the Ion Beam Materials Research Laboratory include the following:

- ES&H SOPs for facility processes
- Approved radiation safety procedures
- Operation procedures
- Training of lab personnel
- Radiation detection equipment with associated alarms and warning systems
- Posting of areas of potential radiation
- Access control for areas of potential radiation

For a list of administrative hazard controls, see Walsh (1997).

1.8.6 Accident Analysis Summary

The Ion Beam Materials Research Laboratory is a low-hazard nonnuclear facility and does not require accident analysis.

1.8.7 Reportable Events

The Ion Beam Materials Research Laboratory has had no occurrences over the past five years.

1.9 Photovoltaic Systems Evaluation Laboratory West

The summary of the Photovoltaic Systems Evaluation Laboratory West and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1994) and Ginn (1998).

1.9.1 Purpose and Need

The Photovoltaic Systems Evaluation Laboratory West is a multipurpose research and testing laboratory that supports the DOE Conservation and Renewable Energy National Photovoltaics Program.

1.9.2 Facility Description

The Photovoltaic Systems Evaluation Laboratory West is made up of light electrical and mechanical labs in Building 833 and photovoltaic arrays that are located between F Street and the NCO Bypass.

1.9.3 Program Activities

Table 4-14 shows the programs that use the Photovoltaic Systems Evaluation Laboratory West and their activities at the facility.

Table 4-14. Program Activities at the Photovoltaic Systems Evaluation Laboratory West

Program	Activities at the Photovoltaic Systems Evaluation Laboratory West
Advanced Manufacturing, Design and Production Technologies	Develop new processes and perform evaluations.
Photovoltaics	Indoor and outdoor testing on photovoltaic cells, modules, arrays, and complete systems. Use of batteries and diesel generators in hybrid system testing.

(Sandia National Laboratories, 1997a)

1.9.4 Summary of Operations

The photovoltaic arrays at the Photovoltaic Systems Evaluation Laboratory West convert solar energy to direct current electricity to demonstrate commercially available systems and to

evaluate their performance. The electricity that the arrays generate is not used for any purpose but is dissipated.

1.9.5 Description of Hazards and Hazard Controls

Hazards at the Photovoltaic Systems Evaluation Laboratory West include the following:

- Electrical hazards from the following:
 - AC motor generator set
 - DC motor generator set
 - Hughes PV array
 - Stand-alone batter bank
 - Battelle PV Array
 - Diesel generator
 - Hybrid battery bank
- Mechanical hazards from a drill press and power tools
- Thermal hazards from resistive load banks
- Environmental hazards from solder waste

Flooded 12-V lead-acid batteries for the arrays present chemical and electrical hazards. To control those hazards, the batteries are placed in secondary containment and the battery terminals are electrically isolated to prevent accidental shorting. An activity-specific ES&H SOP and Bundy (1996) govern:

- Use, handling, and maintenance of the batteries.
- Hazards from the electricity generated by the photovoltaic arrays.

See Ginn (1998) for a list of administrative controls for hazards at the Photovoltaic Systems Evaluation Laboratory West, including ES&H standard operating procedures and required and manager-specified ES&H training.

1.9.6 Accident Analysis Summary

The Photovoltaic Systems Evaluation Laboratory West is a low-hazard nonnuclear facility and does not require accident analysis.

1.9.7 Reportable Events

The Photovoltaic Systems Evaluation Laboratory West has had no occurrences over the past five years.

2.0 NOTABLE FACILITIES IN TECH AREA III

2.1 Introduction

SNL's Tech Area III is devoted to full-scale functional testing of weapons systems and their components, including simulation of a variety of natural and induced environments. These tests verify the accuracy and validity of computer models that design and evaluate the performance, operation, safety, and reliability of weapons systems. Notable facilities with NEPA significance in Tech Area III include the following:

- A radiant heat facility
- A liquid metal processing laboratory
- A classified document destruction facility

SNL and Kirtland Air Force Base (KAFB) control activities on the land immediately surrounding Tech Area III.

The information on Tech Area III facilities in this section is only as current and complete as the safety documentation upon which that information is based. In some cases, the sources of information for this section are out of date and incomplete, and the discussions of facilities in this section reflect those problems. Descriptions of facilities that have abundant safety documentation are developed more fully in this section than descriptions of facilities that, for one reason or another, do not have abundant documentation. (For example, the descriptions of chemical inventories for facilities that require offsite emergency planning is more complete than the descriptions of chemical inventories for facilities that do not require offsite emergency planning.) Though it results in unevenness in the level of detail throughout this section, each facility description is as complete as the supporting documentation will allow.

In all cases, the accuracy and completeness of the information on facilities in this chapter must be verified before that information is incorporated into the SNL/NM sitewide environmental impact statement.

2.2 Radiant Heat Facility

The summary of the Radiant Heat Facility and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1996) and Gill (1997).

2.2.1 Purpose and Need

The Radiant Heat Facility provides the capability to study or prove the ability of a test item, such as a satellite component or a transportation container, to withstand an accident involving a fire. These tests are required by organizations such as the Nuclear Regulatory Commission and the U.S. Department of Transportation.

2.2.2 Facility Description

The Radiant Heat Facility is a low-hazard facility located in Building 6538 and in an adjacent concrete bunker, and it includes a large array of electrically powered heat lamps.

2.2.3 Program Activities

Table 4-15 shows the programs that use the Radiant Heat Facility and their activities at the facility.

Table 4-15. Program Activities at the Radiant Heat Facility

Program	Activities at the Radiant Heat Facility
Direct Stockpile Activities	Environmental, safety, and survivability testing for nuclear weapon applications.
Performance Assessment Science and Technology	Simulation of high-temperature environments for weapon systems and components testing.
Hazardous and Radioactive Material Transportation	Testing of radioactive material packagings for thermal accident conditions.
Nuclear Energy Research and Development	Small-scale testing to support reactor vessel annealing research.
Sustaining Critical Progress in Model Validation	Validation of models to understand thermally driven transport through foam encapsulants for the assessment of nuclear weapon response to abnormal environments.

(Sandia National Laboratories, 1997a)

2.2.4 Summary of Operations

In tests at the Radiant Heat Facility, test items are exposed to a large array of electrically powered heat lamps that create a high-temperature heating environment similar to that of fires that result from transportation accidents.

A typical test lasts 30 minutes, and the tests are conducted on a regular basis, averaging two tests per week over a calendar year.

2.2.5 Description of Hazards and Hazard Controls

Hazards at the Radiant Heat Facility include the following:

- X-ray hazards
- Potential electrical hazards from standard power tools and the transformer system
- Mechanical hazards from a drill press
- Thermal hazards from the following:
 - Despatch oven
 - Environmental chamber
 - Fluidized bed
 - Radiant heat panels
- Pressure hazards from DOT bottles
- Environmental hazards from household chemicals

Administrative controls for these hazards include operating procedures, ES&H standard operating procedures, and required training. For a list of these controls, see Gill (1998).

During testing, combustible materials contained within test units, which are typically small shipping or component containers that can contain up to 150 lb of combustible material such as polyurethane foam, wood, epoxies, encapsulant materials, and electronic boards, may pyrolyze and release decomposition products to the environment. The pyrolysis products encounter the surrounding air at a much greater temperature than their auto-ignition temperatures. At these elevated temperatures, further decomposition takes place, which ultimately releases only carbon dioxide and water to the environment.

Some test units will smolder after a test and release some decomposition products. The maximum possible release of any product is below reportable quantity limits.

The facility stores a total of approximately 10 gal of chemicals in authorized flammable material storage cabinets or in metal cabinets, depending on the chemical, and uses approximately 10 gal of chemicals per year. These chemicals include:

- Solder
- Epoxies
- Lubricants such as WD-40
- Solvents
- Aerosol dusters
- Adhesives

The facility also stores approximately 10 bottles of compressed gases, including:

- Air
- Carbon dioxide
- Helium
- Nitrogen
- Argon

Chemicals and compressed gases are used and stored according to a site-specific ES&H SOP.

2.2.6 Safety Analysis Summary

The Radiant Heat Facility is a low-hazard nonnuclear facility and does not require accident analysis.

2.2.7 Reportable Events

Table 4-16 lists the only occurrence report for the Radiant Heat Facility over the past five years.

Table 4-16. Occurrence Report for the Radiant Heat Facility

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-2000-1993-0002	Discharge of Water Reportable to New Mexico Environmental Division	2E	A float failed to shut off water to the closed-loop cooling system.

2.3 Liquid Metal Processing Laboratory

The summary of the Liquid Metal Processing Laboratory and its operations, hazards, and hazard controls is drawn from Banda and Williams (1996), Maroone (1997), and primary hazard screenings of individual operations or processes within the facility.

2.3.1 Purpose and Need

The mission of the Liquid Metal Processing Laboratory is to provide:

- Research in metals and solidification practices and processes.
- Assistance to the specialty metals industry to help make this industry more competitive in the world market.
- Support of SNL's and DOE's weapons research community in the form of prototypic investment castings.
- Assistance to industry in the development of castings and the understanding of processes.
- Development to demonstrate the feasibility of recycling radioactively contaminated metals.
- Production of special metal alloys as needed by the weapons research community.

2.3.2 Facility Description

The Liquid Metal Processing Laboratory is located in Building 6630, which is a one-story building with a highbay and attached office buildings. The building is constructed of a concrete slab foundation and concrete masonry unit and corrugated metal walls. The facility includes several major pieces of melting equipment:

- Vacuum arc remelt furnace
- Electroslag remelt furnace

- Electron beam melting furnace
- Porous metals melting furnace
- Investment casting vacuum induction/skull melting furnace

2.3.3 Program Activities

Table 4-17 shows the programs that use the Liquid Metal Processing Laboratory and their activities at the facility.

Table 4-17. Program Activities at the Liquid Metal Processing Laboratory

Program	Activities at the Liquid Metal Processing Laboratory
Direct Stockpile Activities	Environmental, safety, and survivability testing for nuclear weapon applications.
System Components Science and Technology	Development of metallurgical processing techniques to fabricate weapon components (for example, housings).
Chemistry and Materials Science and Technology	Development of advanced metal alloys and techniques for processing these alloys.
Initiatives for Proliferation Prevention	Evaluation of material samples provides by FSU researchers.
Advanced Industrial Concepts/Materials Research	Research and development of materials

(Sandia National Laboratories, 1997a)

2.3.4 Summary of Operations

Activities in the Liquid Metal Processing Laboratory include those involving the following equipment and processes:

- Vacuum arc remelt furnace
- Vacuum induction melting furnace
- Electroslag remelt furnace
- Electron beam melting furnace
- Porous metals melting furnace
- Levitation melting furnace
- Induction heating apparatus
- Flash-fire dewax furnace
- Investment casting vacuum induction melting furnace
- Chemical etching
- Clamshell and air-melt furnaces

2.3.4.1 Vacuum Arc Remelt Furnace Operations

Activities at the vacuum arc remelt furnace include vacuum arc remelting, which is a secondary refining process of production of segregation-sensitive metal alloys. A cylindrically shaped electrode is loaded into the furnace body, which consists primarily of a long, cylindrically shaped, water-cooled, copper crucible. The furnace is closed and evacuated to a pressure of about 1 Pascal. Electrical current is supplied to the furnace and an electrical arc is struck between the electrode and some starting material in the bottom of the furnace crucible. The arc heats the electrode tip and the start material until the electrode tip becomes molten. Material drips from the electrode tip into the molten pool below, and the electrode is gradually consumed while the pool level rises. During the melt, a variety of diagnostics are employed to monitor and analyze furnace voltage, current, and arc properties.

2.3.4.2 Vacuum Induction Melting Furnace Operations

The vacuum induction melting furnace is capable of melting and casting 230 kg (steel measure) of molten metal into investment casting shell molds or iron molds in a vacuum, inert gas, or air environment. The metal is melted in a ceramic crucible by an induced electrical current supplied from magnetic fields created by a water-cooled, insulated copper coil that surrounds the ceramic crucible. Alternating current at a maximum of 360 amperes and at voltages of less than 550 volts is supplied to the coil through water-cooled, insulated leads from a commercial power supply rated at 200 kW. Cooling water is supplied by a closed-loop water system. Typical metal temperatures range from 700°C to 1,700°C.

2.3.4.3 Electroslag Remelt Furnace Operations

Operations at the electroslag remelt furnace include a secondary refining process for production of segregation-sensitive metal alloys. During operation, a molten ionic slag is contained in a water-cooled copper mold. Below the slag is solidifying ingot that forms when drops of liquid metal fall from an electrode immersed in the top of the slag layer. Typical temperatures of material slag (typically $\text{CaF}_2\text{-Al}_2\text{O}_3\text{-CaO}$) reach approximately 1,700°C with about 15 kg of material present in the mold. The volume of the molten metal pool is typically 3,800 cm³, and the pool is contained in a bowl-shaped region on the top of the solidifying ingot. The slag is resistively heated by AC power operating at 30 V to 50 V and 3 kA to 5 kA.

2.3.4.4 Electron Beam Melting Furnace Operations

The electron beam melting furnace provides secondary vacuum melting for metals purification or melting for consolidation, purification, and casting of material. The furnace generates electron beams to melt the materials in a vacuum within a water-cooled copper hearth. From

the hearth, metal feeds into a water-cooled, copper retracting mold or into molds to cast parts. The electron beams are formed and accelerated at 30 kV (maximum) in two guns (60 kW and 250 kW) that are attached to the lid of the main chamber.

2.3.4.5 Investment Casting Vacuum Induction Melting Furnace Operations

The investment casting vacuum induction melting furnace is capable of melting and casting up to 91 kg of steel or 23 kg of titanium (vacuum only) into investment casting shell molds in a vacuum or air environment. The metal is melted in a ceramic or water-cooled copper crucible by an induced electrical current supplied from magnetic fields created by an insulated, water-cooled copper coil that surrounds the ceramic or copper crucible. Alternating current at 3,000 Hz (650 amperes maximum) at voltages of less than 550 V is supplied to the melting coil through water-cooled insulated leads from a commercial power supply rated at 350 kW. A second power supply is capable of heating molds inside the furnace under vacuum or inert gas. Graphite susceptor rings that encircle the mold are heated by induction coils. Alternating current of a maximum 350 amperes and of less than 400 V is supplied to the heating coils through water-cooled, insulated leads from a commercial power supply rated at 125 kW. The investment casting vacuum induction melting furnace is also capable of performing real-time radiography on molds as they are filled with metal; however, this capability is not currently used.

2.3.4.6 Porous Metal Furnace Operations

The porous metal furnace is capable of melting and casting up to 23 kg steel measure into molds of ceramic or water-cooled copper in an air, vacuum, or pressurized environment. The metal is melted in a ceramic or water-cooled copper crucible by an induced electrical current supplied from magnetic fields created by an insulated, water-cooled copper coil surrounding the ceramic or copper crucible. Alternating current at 3,000 Hz (650 amperes maximum) at voltages of less than 550 V is supplied to the melting coil through water-cooled insulated leads from a commercial power supply rated at 175 kW. Cooling water is supplied by a closed-loop water system. Typical molten metal temperatures range from 700°C to 1,700°C.

2.3.4.7 Levitation Melting Furnace Operations

The levitation melting equipment is capable of melting approximately 5 g of metal and is usually used for containerless melting of CP titanium. The unit consists of two water-cooled RF copper coils wrapped in various configurations. The top coil melts the titanium. Current at 4,000 kHz (maximum of 350 amperes) and voltages of less than 600 volts is supplied to the top melting coil through water-cooled leads from a commercial power supply rated at 30 kW. The molten titanium is suspended in place by the magnetic fields created by the coil. The power supply is then turned off and the molted titanium drops into a ceramic crucible located directly below.

The ceramic crucible sits in a graphite susceptor and is preheated by the bottom copper coil. Current at 8,000 kHz (maximum of 0.83 amperes) and voltages of less than 4,400 V is supplied to the bottom melting coil through water-cooled leads from a commercial power supply rated at 2.5 kW. The titanium, graphite, and ceramic crucible are enclosed in a quartz tube with the copper coils on the outside of the tube. The tube is evacuated to approximately 10^{-5} torr before melting is initiated. Cooling water is supplied by two independent closed-loop water systems. Typical temperatures of the molten titanium are near 1,700°C.

2.3.4.8 Induction Heat Treating Equipment Operations

The induction heat treating machines are capable of heating metal bars and hardened steel bars of up to about 1 in. in diameter. The metal bars are placed in a strong alternating magnetic field that induces heating currents in the bars. Typical temperatures of the metal range from 70°F to 2,300°F. The metal and steel bars can be quenched to nearly room temperature with a water spray after heating. The magnetic fields that heat the metal bars are created by passing alternating current through a water-cooled copper coil that partially surrounds the metal bars.

2.3.4.9 Flash-Fire Dewax Furnace Operations

The flash-fire dewax furnace is a propane-fired, afterburner-equipped kiln that removes wax and other combustible pattern materials from ceramic investment casting shells. A gas burner system heats the kiln to a desired temperature, and a moving ceramic bed introduces molds into the hot zone. The molds are inverted so that a majority (approximately 80 percent) of the wax drips through funnels in the bed into an inert gas chamber and ultimately through a drain tube and out of the furnace. The wax is collected in a bucket outside of the furnace. The remaining wax and pattern material is combusted in the furnace, and the remaining hydrocarbons are oxidized in the afterburner section. When the process is complete, the furnace load is either exited and the shells are removed, or the burners are extinguished and the shells are allowed to cool in place. Typical burnout temperatures range from 1,400°F to 2,100°F for two to eight hours.

2.3.4.10 Clamshell Induction Melting Furnace and Air-Melt Furnace Operations

The clamshell induction melting furnace and the stand-alone air-melt furnace are sized for melting and casting up to 100 lb of steel or an equivalent volume of aluminum (approximately 30 lb to 40 lb) in either air or vacuum environment (clamshell only). The majority of furnace operations in the clamshell are associated with investment casting of aluminum parts. The aluminum is normally melted under vacuum conditions (less than 800 millitorr), with the exception of operations that involve opening the split (clamshell) chamber to take samples for

analysis, add material, or insert the preheated ceramic mold. Ferrous alloys are typically melted in the stand-alone air-melt station. The metal is melted in a ceramic crucible by an induced electrical current supplied from magnetic fields created by an insulated, water-cooled copper coil surrounding the ceramic crucible. Alternating current at voltages less than 550 V is supplied to the coil from a commercial power supply rated at 75 kW for the stand-alone air-melt station or at 175 kW for the clamshell furnace. The molten metal is poured into molds either in air or vacuum. Cooling water is supplied by a closed-loop water system. Typical metal temperatures are between 700°C and 1,650°C.

2.3.4.11 Chemical Etching Operations

The purpose of chemical etching of metal samples at the Liquid Metal Processing Facility is to reveal the metallurgical structure of specimens. These specimens are typically preheated by placing them in hot running water in a sink or heating them with a hot plate. Once heated, a specimen is lifted out of the sink, wiped dry, and placed in a plastic tray. A mixed etchant solution is poured over it and allowed to react with the metal surface for several minutes until etching is complete. The specimen is typically tilted on its side and allowed to drain; in some cases, it is plunged into a container of water. The specimen is then placed in a second tray and rinsed with distilled water, followed by propanol. Following rinsing, the specimen is lifted to a drying rack and dried with house compressed air, and the liquid waste that results from the process is drained into containers for disposal.

2.3.5 Summary of Hazards and Hazard Controls

Hazards associated with the Liquid Metal Processing Laboratory generally fall into the following types:

- Potential electrical hazards from furnace power supplies and portable power tools
- Mechanical hazards from motorized handtrucks, overhead cranes and hoists, and machine shop equipment
- Pressure hazards from compressed gas cylinders and vacuum systems
- Confined space hazards
- Fall hazards from elevated working surfaces

- Thermal hazards from furnaces, molten metal, hot plates, and welding and cutting operations
- Hazards from wildlife
- Environmental hazards from slags and chemical etching operations

The vacuum arc remelt furnace also has environmental hazards from depleted uranium and thoriated tungsten legacy waste, and the electron beam melting furnace presents hazards associated with radiation generating devices. The induction heating equipment presents nonionizing radiation hazards.

The hazards at the Liquid Metal Processing Facility are controlled by many administrative and engineered hazard controls. For details on these controls, see the following:

- "MPS-Vacuum Arc Remelt Furnace at the LMPL" (Williamson, 1997)
- "MPS-Vacuum Induction Melting Furnace at the LMPL" (Maguire, 1997c)
- "MPS-Electroslag Remelt Furnace at the LMPL" (Shelmidine, 1997)
- "MPS-Electron Beam Melting Furnace at the LMPL" (Miszkiel, 1997)
- "MPS-Investment Casting Vacuum Induction Melting Furnace" (Maguire, 1997b)
- "MPS-Porous Metals Furnace at the LMPL" (Baldwin, 1997c)
- "MPS-The Levitation Melting Furnace at the LMPL" (Baldwin, 1997b)
- "MPS-Induction Heating Apparatus at the LMPL" (Kelley, 1997)
- "MPS-Flash-Fire Dewax Furnace at the LMPL" (Maguire, 1997a)
- "MPS-Clamshell/Air Melt Furnaces at the LMPL" (Baldwin, 1997a)
- "MPS-Chemical Etching at the LMPL" (Van Den Avyle, 1997)
- "MPS-LMPL Operations" (Maroone, 1997)

2.3.6 Accident Analysis Summary

The Liquid Metal Processing Laboratory is a low-hazard nonnuclear facility and does not require accident analysis.

2.3.7 Reportable Events

Table 4-18 lists the occurrence reports for the Liquid Metal Processing Facility over the past five years.

Table 4-18. Occurrence Reports for the Liquid Metal Processing Facility

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-9000-1996-0001	Project Stopped for Safety Procedure Evaluation	1C	A field radiography process that allowed real-time viewing of a casting operation was halted for safety evaluation.
ALO-KO-SNL-2000-1997-0001	Inadequate Procedure Results in Worker Receiving Minor Electrical Shock During Installation of Replacement Equipment	1F	A worker received a minor electrical shock during installation of an induction furnace.

2.4 Classified Destruction Facility

The summary of the Classified Destruction Facility and its operations, hazards, and hazard controls is drawn from Bruneske (1985), Smith (1987), Kidd (1997), and Jewell (1998).

2.4.1 Purpose and Need

The purpose of the Classified Destruction Facility is to reduce classified information (paper, computer tapes, and microfiche) to a controllable grade of residue. Among the equipment used to perform this activity are the Hammermill macerator, which reduces paper documents, and the Micro DoD plastics shredder, which reduces plastics and film.

2.4.2 Facility Description

The Classified Destruction Facility, which is located in Building 6583, houses equipment necessary to perform its information destruction function, including:

- The Hammermill, which has the following components:

- Conveyor
- Document destructor with blower
- Duct system
- Cyclone separator
- Residue compactor
- Exhaust blower
- Dumpster
- The Micro DoD, which has the following components:
 - Cutting chamber
 - Hopper
 - Hoses and base
 - A 55-gal drum for residue collection

2.4.3 Program Activities

Activities at the Classified Destruction Facility are limited to those associated with reducing classified information (paper and plastics) to a controllable grade of residue and do not directly support the missions of any SNL programs.

2.4.4 Summary of Operations

The Hammermill conveyor feeds classified wastepaper into the document destructor, which turns the paper to residue. The residue travels through the duct system to the cyclone separator, which includes a bag system. The large particles that enter the separator settle directly to the compactor, and the suspended particles collect on the outer surfaces of the bag system. Periodically, a blast of compressed air shakes the bag and causes the residue in the

bag system to drop to the bottom with the larger particles for compaction. The compacted residue is transferred to the dumpster. The Hammermill can process up to 700 lb of paper per hour.

Operation of the Micro DoD shredder involves manually feeding classified film and plastics into the cutting chamber. The chamber is closed and shredding commences, and the residue is transferred through the hosing to a drum collection point. When film that contains silver is processed, the residue is collected separately from other residues and is disposed of properly.

The Hammermill and Mico DoD shredder normally operate four hours per day, three days per week, 50 weeks per year.

2.4.5 Description of Hazards and Hazard Controls

Hazards at the Classified Destruction Facility include mechanical and noise hazards from the macerator and pressure hazards from the compressed air system, and the shredder unit contains blades that must be cleared occasionally, which requires careful attention to personnel safety. Required ES&H training and facility-specific procedures and guidelines control these hazards. No minors are allowed in the facility, and facility personnel observe the two-man rule.

Operations at the Hammermill do not involve hazardous materials or processes; operations of the shredder can involve silver-coated film, the residue from which is handled according to current waste management guidelines. The Classified Destruction Facility has been inspected by air pollution control engineers from the City of Albuquerque, who found that the facility complies with city and county air quality control regulations.

2.4.6 Safety Analysis Summary

The Classified Destruction Facility is a standard industrial hazard facility and does not require accident analysis.

2.4.7 Reportable Events

The Classified Destruction Facility has had no reportable occurrences over the past five years.

3.0 NOTABLE FACILITIES IN TECH AREA IV

3.1 Introduction

The information on Tech Area IV facilities in this section is only as current and complete as the safety documentation upon which that information is based. In some cases, the sources of information for this section are out of date and incomplete, and the discussions of facilities in this section reflect those problems. Descriptions of facilities that have abundant safety documentation are developed more fully in this section than descriptions of facilities that, for one reason or another, do not have abundant documentation. (For example, the descriptions of chemical inventories for facilities that require offsite emergency planning is more complete than the descriptions of chemical inventories for facilities that do not require offsite emergency planning.) Though it results in unevenness in the level of detail throughout this section, each facility description is as complete as the supporting documentation will allow.

In all cases, the accuracy and completeness of the information on facilities in this chapter must be verified before that information is incorporated into the SNL/NM sitewide environmental impact statement.

3.2 High Power Microwave Laboratory

This section provides an overview of the High Power Microwave Laboratory operations and operational accident analysis. A more complete discussion can be found in Weber and Zawadzka (1995), which was approved by DOE in June 1997.

3.2.1 Purpose and Need

The mission of the High Power Microwave Laboratory is to develop a source of high-power microwaves to provide a large, high-quality, electromagnetic test facility capable of supporting DOE and U.S. Air Force vulnerability and susceptibility testing requirements. Experiments in the High Power Microwave Laboratory involve the production of microwave energy by various sources (pulsed-power accelerators) that are in various stages of development.

3.2.2 Facility Description

The High Power Microwave Laboratory is located in Building 963. The facility includes two data acquisition screen rooms, the microwave control/monitor systems, a light laboratory, an attached anechoic chamber, and a large experimental cell that contains the Intermediate Pulsar

(IMP), the Cathode Test Bed (CTB), and the Compact Short-Pulse Repetitive Accelerator (CSPRA). These accelerators contain pulse-power drivers (Marx capacitor banks) capable of generating high-energy electron beams that drive developmental microwave-generating devices. The microwave energy is used to irradiate various experimental objects within the attached anechoic chamber.

The IMP and the CTB are mutually exclusive; electrical interlocks prohibit operation of one machine during the charging and firing of another. The CSPRA is located in a test cell that is separated from the IMP and the CTB by a 2-ft-thick by 9-ft-high block wall. CSPRA has its own control panel and can be charged and fired separately from the other two accelerators.

The accelerators are located within a 2-ft-thick by 9-ft-high concrete barrier with limited and controlled access. The High Power Microwave Laboratory is under continuous surveillance by two closed-circuit television cameras mounted on each end of the cell. The television monitors are located at each of the two charging and firing control consoles located outside of the concrete walls.

3.2.3 Program Activities

Table 4-19 shows the programs that use the High Power Microwave Laboratory and their activities at the facility.

Table 4-19. Program Activities at the High Power Microwave Laboratory

Program	Activities at the High Power Microwave Laboratory
Experimental Activities	Development of microwave technologies for DoD.
Performance Assessment Science and Technology	Development of microwave technologies.

(Sandia National Laboratories, 1997a)

3.2.4 Description of Operations

Currently, the IMP with its annular beam amplifier is the only microwave-producing pulsed-power device that delivers microwave energy to the anechoic chamber. Microwaves from the IMP travel through a waveguide from the test cell in the highbay, through a wall, and into the adjoining anechoic chamber.

The Marx generator that powers the IMP is a 10-stage capacitor bank contained within a 1,255-gal oil tank that delivers a pulse of 1 microsecond duration and up to 1 MV amplitude to

the pulse-forming lines (PFL). The PFL deliver pulses of 300 nanoseconds duration and up to 100 kA at 500 kV to the microwave generator. The microwave generator, an annular beam amplifier, uses a small portion of the electron beam to produce microwaves that various microwave loads absorb. The microwaves are routed through a vacuum tube from the test cell and into the anechoic chamber. The vacuum tube, or microwave guide, is fabricated of metal, is approximately 8 in. in diameter, and is cryogenically maintained at negative 5 atmospheres. The IMP is a single-shot accelerator capable of producing five shots per day, and it produces bremsstrahlung radiation.

The CTB consists of the following:

- An output transformer
- A Marx generator within a 2,065-gal oil tank
- An accelerator with a maximum operating voltage of 500 kV
- A vacuum diode that generates microwaves and some x-ray radiation (bremsstrahlung)

The CTB is a single-shot accelerator capable of producing 40 shots per day. It uses a higher-frequency, signal-producing technology—a gyrotron backward wave oscillator. The CTB Marx generator is an eight-stage capacitor bank that is capable of producing a single-shot electron beam. The electron beam is emitted through a cathode, extracted through an anode, and then compressed by coils as it propagates toward the interaction region. The CTB is currently connected to a dummy load for accelerator pulsed-power testing and will produce no radio frequency radiation during diode testing. It produces x-rays as an intermediate step to its eventual microwave capability. It will eventually replace, or be used in conjunction with, the IMP to produce microwaves for the anechoic chamber experiments.

CSPRA is currently under construction and is not operational. The objectives of this accelerator are to:

- Use state-of-the-art spark gap technology to develop and test a compact, high repetitive-rate, 700-kV linear induction accelerator.
- Design and demonstrate a photoconductive semiconductor switch-based system to replace the spark gap-based system.

3.2.5 Description of Hazards

3.2.5.1 Offsite Hazards to the Public and the Environment

The High Power Microwave Laboratory contains no radioactive material inventory and only a small chemical inventory that cannot be dispersed outside the facility. Accidents at the facility present no potential offsite consequences to either the public or the environment.

3.2.5.2 Onsite Hazards to the Environment

Onsite hazards to the environment include transformer oil. The three transformer oil tanks associated with the IMP, the CTB, and the CSPRA have a maximum capacity of 1,255 gal, 2,065 gal, and 350 gal, respectively. Their operational capacities (when loaded with Marx bank capacitors) drop to 750 gal, 1,240 gal, and 280 gal, respectively. The Shell DIALA A/AX transformer oil is a reduced-flammability grade with a flash point of 300°F, and the polychlorinated biphenyl (PCB) content of the oil is limited to less than 50 ppm. The oil is regularly filtered to maintain breakdown strength.

3.2.5.3 Onsite Hazards to Workers

Potential worker hazards at the High Power Microwave Laboratory include:

- Ionizing radiation, which is produced at the diode of each accelerator within the test chamber walls. Because the accelerators operate at relatively low voltages (less than 10 MeV), activation of test materials or machinery does not occur.
- The Marx generator, which is the prime energy storage component of the accelerators.
- Solvents, including alcohol and hexanes, which are used to clean various components between test shots.
- Dilute copper sulfate solution, which is used to fabricate high-power resistors for use in the Marx generators.
- SF₆, which is used as the insulator gas in switching components. The High Power Microwave Laboratory contains only one bottle of SF₆ at any time. Used gas is exhausted at the east side of the highbay to the outdoors.
- Confined spaces, which include all trenching under and around the High Power Microwave Laboratory.

3.2.5.4 Hazard Controls

Hazard controls at the High Power Microwave Laboratory include:

- **Radiation shielding** - Concrete shielding prevents radiation exposure to personnel in other areas of the Building 963 highbay, including the mezzanine overlooking the RHEPP II laboratory. Because of the thickness of the concrete cell walls and the distances maintained from the diodes, the main floor of the highbay is safe from radiation, even when one of the High Power Microwave Laboratory accelerators is firing.
- **Access control** - Access to the east highbay area of Building 963 is controlled by means of a cipher lock. There are seven gated and electrically interlocked entrances to the High Power Microwave Lab test cell. Five gates on the highbay floor level lead directly into the test cell. Two gates are below ground, blocking a trench that runs beneath the test cell. Before a shot, the hazardous areas are searched to ensure that personnel are out of those areas. During the critical period of charging and firing, the accelerator systems are interlocked with access control so that any breach of the gates or of the doors to the anechoic chamber automatically disables the active accelerator and places it in a safe condition.
- **Secondary oil containment** - Building 963 is constructed with secondary containment in the form of concrete trenching that will contain a catastrophic oil leak. The trenching has alarms located approximately 2 in. from the bottom of the trench that provide warning when any appreciable quantity of liquid accumulates in the trenches. The oil storage tank and pumping system, located in Building 966, are constructed with secondary containment. The oil transfer lines are made of double-walled piping and slope to the concrete catch basin in the basement of Building 966.
- **Confined space safety** - Because the High Power Microwave Laboratory has no basement and because the volume of SF₆ is limited to a single bottle within the laboratory, the potential for an oxygen deficiency hazard does not exist.

For a list of administrative hazard controls, including operating procedures, ES&H standard operating procedures, and required ES&H training, see Toth (1997).

3.2.6 Accident Analysis Summary

3.2.6.1 Selection of Accidents Analyzed in Safety Documents

Generic accidents were selected for qualitative analysis by examining sources of energy, radiation, and toxicological risk through a walk-down of the facility and through discussions with operations personnel. Following the walk-down and qualitative survey of the facility, the operating events selected for qualitative risk analysis were the following:

- Worker electrocution while “safing” Marx generator capacitors
- Worker radiation exposure during accelerator operation

These events are considered to be the bounding accidents that define the safety envelope for facility operations. In addition, the accident analysis for the High Power Microwave Laboratory included natural phenomena event scenarios that are generic to all facilities at SNL, as well as an aircraft crash scenario.

The facility accident analysis did not address standard industrial accidents (for example, accidents that involve hazards such as cranes and hoists, forklifts, lasers, and compressed gases) that are addressed by existing consensus standards for accident prevention and mitigation.

3.2.6.2 Analysis Methods and Assumptions

The methodology used to perform the High Power Microwave Laboratory accident assessment (Mahn *et al.*, 1995) used the accident severity and probability criteria of AL 5481.1B. However, in this methodology the DOE/AL accident severity matrix was enhanced as shown in Table 4-20.

Table 4-20. Hazard Probability

Category	Level	Description	Failure	
			Description	Failure Rate
Frequent	A	Likely to occur	<ul style="list-style-type: none"> One or more system failures per shot Several component failures 	Continually experienced $Pe^* > 10^{-2}$
Reasonably probable	B	Will occur several times in life of an operation or item	<ul style="list-style-type: none"> One system failure in two or more shots Fewer component failures per shot 	Will occur frequently $Pe \cong 10^{-2}$ to 10^{-3}
Occasional	C	Likely to occur sometime in the life of an operation or item	<ul style="list-style-type: none"> One system failure in several shots A maximum of one component failure per shot 	Will occur several times $Pe \cong 10^{-3}$ to 10^{-4}
Remote	D	Unlikely to occur during the life of an operation or item	Unlikely but can reasonably be expected to occur	Unlikely to occur but possible $Pe \cong 10^{-4}$ to 10^{-5}
Extremely improbable	E	So unlikely that it can be assumed that this hazard will not be experienced	Unlikely to occur but possible	Can be assumed that although possible, it will not be experienced $Pe \cong 10^{-5}$ to 10^{-6}
Impossible	F	Physically impossible to occur	Physically impossible to occur	Will not be experienced

* Pe = Probability of event occurring per year.

3.2.6.3 Summary of Accident Analysis Results

The results of the High Power Microwave Laboratory accident assessment are summarized in Table 4-21.

Table 4-21. Summary of Results of the High Power Microwave Accident Assessment

Event	Severity	Probability
Electric shock	Critical (II)	Extremely unlikely (C)
Radiation exposure	Negligible (IV)	Unlikely (B)
Earthquake	Negligible (IV)	Unlikely (B)
Tornado	Catastrophic (I)	Unlikely (B)
High winds	Negligible (IV)	Likely (A)
Flood	Negligible (IV)	Unlikely (B)
Aircraft crash	Catastrophic (I)	Unlikely (B)

3.2.7 Reportable Events

The High Power Microwave Laboratory has had no reportable occurrences over the past five years.

3.3 Pelletron

3.3.1 Purpose and Need

The Pelletron accelerator was used to simulate electron environments in space and in nuclear reactors and to establish radiation transport code benchmarks.

3.3.2 Facility Description

The Pelletron accelerator is a DC electron-beam accelerator that was moved to its present location in Building 962 in 1990. The accelerator, vacuum system, SF₆ gas handling system, and electron-beam focusing coils are located inside a radiation test cell. The control console and monitoring electronics are located immediately outside the test cell.

3.3.3 Program Activities

No SNL programs conduct activities at the Pelletron accelerator.

3.3.4 Summary of Operations

The Pelletron accelerator was only operated to determine its functionality and the adequacy of its radiation shielding. It never became operational and has been permanently shut down due to evidence of inadequate overhead shielding. The accelerator remains locked out in a nonoperational status with no plans to bring it back into operation.

Pelletron was designed so that the electron-beam could be extracted into the test cell directly or the energy converted to bremsstrahlung radiation using a high-Z converter at the exit port.

3.4 PROTO II

3.4.1 Purpose and Need

PROTO II was originally designed and constructed as a prototype for driving inertially confined fusion targets. In 1986 it was converted into an x-ray simulator.

3.4.2 Facility Description

PROTO II is an eight-module, radially converging, pulsed x-ray simulator.

3.4.3 Program Activities

No SNL programs conduct activities at the PROTO II facility.

3.4.4 Summary of Operations

PROTO II is in a completely nonoperational state with all fluids drained and energy sources locked out. There are no plans to bring this accelerator back into operation.

By using an imploding plasma as a load, PROTO II can generate soft x-rays for materials effects testing, and by using a bremsstrahlung load, it can produce x-rays with up to a 1.5-MeV endpoint energy for electronics vulnerability and survivability tests. The eight Marx generators charge 16 intermediate water-insulated capacitors. Eight triggered gas-insulated switches then transfer the energy through oil-water interfaces into 16 pulse-forming transmission lines. As the energy approaches the diode, a convolute section reconfigures the three-plate feed into a five-plate transmission line transformer, which feeds a five-plate water-vacuum interface insulator stack. Conical magnetically insulated transmission lines (MITLs) in the vacuum section feed power to the load.

3.5 Excimer Laser Processing Laboratory

The summary of the Excimer Laser Processing Laboratory and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1995) and Cameron (1998).

3.5.1 Purpose and Need

The Excimer Laser Processing Laboratory is used by scientists, engineers, and technicians to investigate and develop materials processing technologies using high peak-power laser energy.

3.5.2 Facility Description

The Excimer Laser Processing Laboratory is located on the second floor of Building 960 in Room 2217. The major equipment operated within the facility includes the following:

- A pulsed 10-Hz continuous-wave Nd:YAG laser system with harmonic generators and dye system
- A pulsed 25-Hz Excimer laser (Class IV) with associated fluorine and hydrogen chloride gases in gas cabinets
- HeNe alignment lasers (Class II and Class III)
- A ¾-m monochrometer
- A quadrupole mass spectrometer
- A glove box with purification system
- An automated robotic arm
- Associated computers for equipment control

3.5.3 Program Activities

No programs reported activities at the Excimer Laser Processing Laboratory.

3.5.4 Summary of Operations

In operations at the Excimer Laser Processing Laboratory, personnel:

- Routinely operate the Nd:YAG laser systems and the Excimer laser system for optical diagnostics and for materials processing, including melting, cutting, drilling, and vaporization.
- Operate and maintain the robotic arm and the glove box.
- Use chemicals for a variety of processes, including:
 - Maintenance of optical components used in laser setups, high-vacuum systems, and ablation samples.

- Cleaning operations.
- Sample preparation.

- Vacuum system operation and maintenance.

- Investigation of ablation sample reactions.

3.5.5 Description of Hazards and Hazard Controls

Hazards at the Excimer Laser Processing Laboratory include the following:

- Laser hazards from the Class IV Nd:YAG laser

- Thermal hazards from the vacuum system

- Pressure hazards from the compressed gas cylinders and the vacuum system

For a list of administrative controls for the hazards at the Excimer Laser Processing Laboratory, including ES&H standard operating procedures and required ES&H training, see Cameron (1998).

Operation of the Excimer laser requires a mixture of 5 percent hydrogen chloride or 5 percent fluorine gas in helium. These gas mixtures are contained in gas cylinders that reside in two ventilated gas cabinets. Each gas cabinet contains a cylinder of helium as purge gas and activated charcoal absorption traps that capture residual amounts of the halogen during a gas manifold purge. As a result, no halogenated gases are released into the Building 960 exhaust system during normal operation of the Excimer laser system.

An absorption trap, which lab personnel remove and replace during routine maintenance, is also located inside the laser for halogen removal. The gas transfer lines that deliver the halogens to the laser are 316 stainless steel with welded joints or compressed fitting connections. The Excimer Laser Processing Laboratory is also equipped with a fluorine and hydrogen chloride gas detection system to monitor the lab atmosphere and the exhaust duct in the event of a gas leak. The laser enclosure is connected to the exhaust system vent. SNL industrial hygiene, safety, and facilities personnel have reviewed and approved the gas installation setup in this lab.

The radiological hazards in Building 960 fall below the screening criteria in 10 CFR 30.72.

3.5.6 Accident Analysis Summary

The Excimer Laser Processing Laboratory is a low-hazard nonnuclear facility and does not require accident analysis.

3.5.7 Reportable Events

Table 4-22 lists the only occurrence report for the Excimer Laser Processing Laboratory over the past five years.

Table 4-22. Occurrence Report for the Excimer Laser Processing Laboratory

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-7000-1994-0003	Employee Receives an Electric Shock	10B	A maintenance electrician received an electrical shock while working on the installation of new variable frequency drives for the building heating, ventilation, and air conditioning system.

4.0 NOTABLE FACILITIES IN COYOTE TEST FIELD, MANZANO AREA, AND OTHER LEASED AREAS

4.1 Introduction

The information on notable facilities in Coyote Test Field and Manzano Area in this section is only as current and complete as the safety documentation upon which that information is based. In some cases, the sources of information for this section are out of date and incomplete, and the discussions of facilities in this section reflect those problems. Descriptions of facilities that have abundant safety documentation are developed more fully in this section than descriptions of facilities that, for one reason or another, do not have abundant documentation. (For example, the descriptions of chemical inventories for facilities that require offsite emergency planning is more complete than the descriptions of chemical inventories for facilities that do not require offsite emergency planning.) Though it results in unevenness in the level of detail throughout this section, each facility description is as complete as the supporting documentation will allow.

In all cases, the accuracy and completeness of the information on facilities in this chapter must be verified before that information is incorporated into the SNL/NM sitewide environmental impact statement.

4.2 Manzano Waste Storage Facilities

An overview of the Manzano Waste Storage Facilities' operations and operational accident analysis is provided below. A more complete discussion can be found in Sandia National Laboratories (1997b) and Mantay (1997).

4.2.1 Purpose and Need

The U.S. Department of Defense (DoD) constructed the Manzano Storage Facilities' bunkers in the 1940s to store explosives, and the bunkers are currently owned by the U.S. Air Force, which until recently had also maintained and operated them. Currently, DOE leases the facilities from the U.S. Air Force for SNL/NM to use as a *Resource Conservation and Recovery Act (RCRA)* storage facility for mixed waste, low-level radioactive waste, and transuranic waste.

4.2.2 Facility Description

The Manzano Storage Facilities' bunkers are located in the southeast portion of KAFB in the western Manzanita Mountains, and it is accessible from a paved road that encircles the mountain into which the facility is built.

4.2.3 Program Activities

Table 4-23 shows the programs that use the Manzano Waste Storage Facilities and their activities at the facility.

Table 4-23. Program Activities at the Manzano Waste Storage Facilities

Program	Activities at the Manzano Waste Storage Facilities
Waste Management Operations	Storage of mixed, transuranic, and radioactive wastes that await disposal, treatment, or other disposition.

(Sandia National Laboratories, 1997a)

4.2.4 Summary of Operations

The Manzano Waste Storage Facilities' bunkers are listed on a RCRA Part A permit application, are operating under RCRA interim status, and are required to comply with RCRA regulations for hazardous and mixed waste storage. Periodically, waste management personnel inspect, handle, and move containers at the facility and may open the outer containers of multiple-container packages; however, the inner containers of packages are not opened at the facility, and no process operations are performed there.

Facility activities are grouped into the following operations:

- Material loading and unloading at the entrance of individual bunkers
- Material handling within the bunkers
- Maintenance
- Transportation activities on the roads of the Manzano complex
- Inspections, audits, and tours

Typical waste that the bunkers store includes tritium-contaminated equipment and cleanup material and experimental test units. The bunkers can also store waste that requires restricted-access storage because of classified information, high activity levels, or other criteria as approved by waste management personnel.

Waste management personnel collect waste containers from various generators at SNL/NM and transport them to the Manzano Waste Storage Facilities. The generators of wastes are responsible for properly identifying, segregating, and documenting their wastes. The generator certifies the waste contents and documents that certification on the disposal request for radioactive or mixed waste, which serves as the primary basis for assessment and characterization, and normally performs sampling and analysis of waste in accordance with Sandia National Laboratories (1996) before the facility receives the waste. If sampling of legacy waste is required, the waste can be taken to other SNL/NM facilities for analysis. SNL/NM generators of surplus nuclear material follow a process similar to the process that waste generators follow.

Before collecting waste containers from generators, waste management personnel determine if the waste meets the requirements for acceptance and storage by:

- Surveying all waste containers for exposure levels.
- Swiping containers for external contamination.

- Visually inspecting containers to verify container integrity.
- Reviewing characterization data provided by the waste generator to establish the following:
 - Waste type
 - Compatibility of the waste or material with storage requirements
 - Completeness of the characterization data
 - Compatibility of the waste with disposal site acceptance criteria
 - Suitability of waste packaging
- Determining whether waste meets the waste acceptance criteria established in SNL procedures.

If the waste satisfies all relevant waste acceptance criteria for storage at the facility, it is moved by truck to the bunkers.

Waste management personnel accept a variety of containers. Types of “strong-tight” containers that may be used include steel drums, steel boxes, wooden crates, and plastic containers. The steel drums are frequently DOT Type A drums, which have steel rings that clamp or bolt to hold the lids in place. Some of the waste containers may contain shielding materials to reduce the surface radiation dose levels to below the acceptable limit for contact-handled waste, which is 200 millirem per hour at the package surface. Mixed waste is always stored in containers, but radioactive waste material that does not fit into standard containers is contained and stored in the bunkers in an orderly manner. Containers of liquid waste are not stored at the Manzano Waste Storage Facilities without the approval of the SNL/NM Nuclear Criticality Safety Committee.

Once received at the Manzano Waste Storage Facilities, waste or material containers are again inspected before they are moved by forklift to the appropriate storage areas. If a secondary (or external) container is damaged, the container can be placed into an overpack, the intact contents can be moved into another container at the bunkers, or the damaged container can be sent to another SNL/NM facility for repackaging.

Trained waste and nuclear material handlers use manual or power equipment (trucks and forklifts) as appropriate to handle materials within the Manzano Waste Storage Facilities.

Handlers use electric forklifts whenever feasible, and they also use diesel, gas, or propane forklifts to move particularly heavy items (weighing in excess of 2,000 lb).

4.2.5 Description of Hazards and Hazard Controls

The principal hazards associated with the Manzano Waste Storage Facilities result from radioactive and toxic material in the storage bunkers in the form of mixed waste, low-level radioactive and transuranic waste, nuclear material, and hazardous substances as constituents of mixed waste, which could include reactive, combustible, or toxic materials.

Hazards at the Manzano Waste Storage Facilities also include:

- Mechanical hazards from forklifts, motor vehicles, and rigging used in conjunction with forklifts.
- Hazards from insects, animals, and snakes.
- Asbestos mixed with concrete within blast-resistant doors. (Asbestos in the doors would not be disturbed unless the doors were torn apart.)
- Hazards related to material handling activities.
- Lightning and severe weather hazards.

An approach consistent with current DOE hazard analysis practices (U.S. Department of Energy, 1992b; DOE 5480.23), leading industrial hazard evaluation procedures (AICE, 1992), and Department of Defense failure analysis standards (U.S. Department of Defense, 1980) was used to perform a qualitative screening of hazards at the Manzano Waste Storage Facilities.

4.2.5.1 Offsite Hazards to the Public and the Environment

Offsite hazards to the public include radioactive or toxic material releases resulting from a fire or explosion. The analysis identified no offsite hazards to the environment.

4.2.5.2 Onsite Hazards to the Environment

Onsite hazards to the environment include radioactive or toxic material spills.

4.2.5.3 Onsite Hazards to Workers

Onsite hazards to workers include exposure to radiation or toxic materials and material handling accidents.

4.2.5.4 Hazard Controls

Radionuclide quantity limits are observed to ensure that inventories remain below the hazard category (HC) 2 thresholds of U.S. Department of Energy (1992b). Administrative controls limiting the type and quantity of the hazardous constituents of the mixed waste stored in the bunkers are generally based on the "final" reportable quantity values of hazardous substances listed in 40 CFR 302. Because of the nature of the Manzano Nuclear Waste Storage Facility and its operations, the potential to cause significant environmental insult through a release does not exist.

Material handlers consider fuel fire hazards and availability of equipment in selecting the most appropriate type of forklifts for handling materials. Other than the typical fuels, batteries, and lubricants associated with forklifts, material handlers use no hazardous materials in handling waste containers at the bunkers, and they also maintain clear aisles throughout the bunkers to facilitate safe egress and inspections.

Radiological control technicians routinely survey the bunkers for radiological contamination, and they also survey the bunkers for radiological dose. Workers moving materials into or out of the bunkers must wear personal dosimeters. Chemical monitoring is provided whenever gas, propane, or diesel forklifts are in use in the bunkers, and portable A-B-C fire extinguishers are available by the outer doors of each bunker for fighting small fires.

For a list of administrative controls for the hazards at the Manzano Nuclear Waste Storage Facility, including procedures and required and manager-specified ES&H training, see Mantay (1997).

4.2.6 Accident Analysis Summary

4.2.6.1 Selection of Accidents Analyzed in Safety Documents

Based on the results of a hazard analysis, the only accident scenario that presents the possibility of an offsite release of radioactive or toxic material is a fire or explosion. Fires present a greater risk than explosions because of a higher likelihood of occurrence.

Specifically, a vehicle fire involving waste packages outside of a bunker is the most likely and the most limiting accident scenario.

4.2.6.2 Analysis Methods and Assumptions

The analysis assumes the following:

- A fire starts due to a malfunction or a fuel leak from the vehicle.
- A waste package, which contains the maximum allowable hazard category (HC) 3 quantity of radioactive material and the maximum quantity of toxic material allowed per the technical safety requirements, becomes fully involved in the fire. This bounding accident scenario was analyzed using a deterministic approach to evaluate its consequences.

Another assumption is that the fire produces a plume of radioactive and toxic material that disperses radially from the location of the waste package. For purposes of evaluating the consequences of this accident with respect to DOE evaluation guidelines, the maximally exposed offsite individual is assumed to be located at the site boundary, 480 m from the Manzano Waste Storage Facilities fence line.

Radioactive source-term analysis assumptions include the following:

- Damage ratio of 1.0
- Overall facility leak path factor of 1.0
- Material-at-risk at the maximum allowable HC 3 quantity of plutonium-239 (Pu-239) specified in U.S. Department of Energy (1992b)
- Released Pu-239 entirely of inhalation class W material
- Airborne release fraction of 5×10^{-4}
- Respirable fraction of 1.0

The assumptions used in the toxicological source-term analysis and the methodology used to calculate the source terms are detailed in Mahn (1996). Although radioactive and toxic material releases were modeled somewhat differently, the following modeling features and assumptions are common to both analyses:

- The maximally exposed offsite individual is located 480 m downwind of the release.
- The source term is released at ground level with consequences assessed to a center-line receptor located at ground level.
- Atmospheric stability is class F and the wind speed is 1 m/second.
- The maximally exposed offsite individual is not evacuated or relocated.

Simple, steady-state Gaussian plume calculations were used to estimate a 50-year effective dose equivalent (EDE) radiological exposure to Pu-239. The EPICODE computer code (Homann Associates, Inc., 1992) was used to estimate the downwind toxicological dose resulting from the release of hazardous substances.

4.2.6.3 Summary of Accident Analysis Results

The results of the toxicological dispersion modeling calculations, using the maximum quantities of toxic materials as indicated in “4.2.6.2, Analysis Methods and Assumptions,” indicate that the release of osmium tetroxide, sodium azide, and toluene diisocyanate during a fire would produce the following toxicological exposures to the maximally exposed offsite individual:

- 0.044 mg/m³ of osmium tetroxide
- 0.44 mg/m³ of sodium azide
- 0.26 mg/m³ of toluene diisocyanate

These exposures exceed the offsite evaluation guidelines of 0.0016 mg/m³, 0.2 mg/m³, and 0.036 mg/m³, respectively, for these materials. The release of all other toxic substances during the fire would not exceed offsite evaluation guidelines. Therefore, to preclude exceeding offsite evaluation guidelines for all possible toxic releases, the following supplemental material limits and conditions are imposed:

- The maximum inventory of osmium tetroxide, sodium azide, and toluene diisocyanate allowed per bunker is restricted to no more than 20 lb, 300 lb, and 10 lb, respectively.
- Bulk, solid metals allowed in the bunkers will be restricted to arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. The maximum allowable inventory of each

solid metal will be restricted to 100 times the final reportable quantity value listed in 40 CFR 302.

- Due to the general and conservative nature of the analysis, higher inventory values may be established based on risk analysis specific to waste form or storage configuration, which allows for a more realistic treatment of the wide variety of waste forms and storage containers in which hazardous substances could be present.

The results of the radiological dispersion modeling calculations indicate that the release of radionuclides during a fire could produce a 50-year EDE to the maximally exposed offsite individual of 2.8 rem at 480 m, which is approximately a factor of 10 lower than the offsite evaluation guideline of 25 rem to the whole body.

4.2.7 Reportable Events

The Manzano Waste Storage Facilities have not had any occurrences over the past five years.

4.3 National Solar Thermal Test Facility

The summary of the National Solar Thermal Test Facility and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1992a) and Kolb (1997).

4.3.1 Purpose and Need

The National Solar Thermal Test Facility is a major test facility for DOE-funded solar energy programs.

4.3.2 Facility Description

The National Solar Thermal Test Facility is situated on KAFB in CTF within a fenced and developed area of approximately 115 acres. The facility includes solar furnaces, parabolic dishes, parabolic troughs, and a field of 222 computer-controlled heliostats that reflect concentrated solar energy onto a 200-ft receiving tower.

4.3.3 Program Activities

Table 4-24 shows the programs that use the National Solar Thermal Test Facility and their activities at the facility.

Table 4-24. Program Activities at the National Solar Thermal Test Facility

Program	Activities at the National Solar Thermal Test Facility
Solar Thermal	Research, development, and testing of solar thermal systems and components. The testing includes instrumentation, measurement, and data analysis. Most testing involves very high temperatures and high fluxes, and many systems use molten nitrate salts and sodium as heat transfer fluids.
Other Federal Agencies	Work for other agencies includes nonsolar testing activities such as providing large-scale optics for astronomical observations and atmospheric sounding.

(Sandia National Laboratories, 1997a)

4.3.4 Summary of Operations

Test operations at the National Solar Thermal Test Facility provide high thermal flux for the following:

- Solar applications
- Investigation of the thermophysical properties of materials
- Measurements of the thermal performance of components and materials
- Measurements of the effects of aerodynamic heating on radar transmission
- Simulation of nuclear thermal flash

The National Solar Thermal Test Facility also provides large-scale optics for astronomical observations and atmospheric sounding.

4.3.5 Description of Hazards and Hazard Controls

Hazards at the National Solar Thermal Test Facility include the following:

- Potential electrical hazards from power panels
- Mechanical hazards from drills, grinders, saws, motors, compressors, and other rotating equipment

- Confined space hazards
- Hazards related to wild animals
- Environmental hazards from a 50-ft sump

Concentrated sunlight generated in the course of normal operations disperses within 200 ft or less to below the intensity of normal sunlight, and it occurs only within the fence and within 500 ft of the ground surface. Adherence to ES&H SOPs protects worker health and provides worker safety from concentrated solar energy.

Hazardous waste produced at the National Solar Thermal Test Facility includes small quantities of used oil or grease, solvents, excess paint, and similar material. Larger quantities of waste include nitrate salts and oils used as heat-transfer media. Hazardous wastes are stored, transported, and disposed of according to all applicable laws, regulations, DOE orders, and permit requirements.

Small quantities of solvent are stored for incidental use. The facility also stores larger quantities of heat-transfer media, such as nitrate salts, oils, and sodium metal.

Some solar energy systems use oils as working fluid, and the heliostat field operates on diesel power. The facility stores diesel fuel, gasoline, and propane for use in engines and heaters, and underground storage tanks for these materials are monitored.

Pesticides and herbicides are used at the National Solar Thermal Test Facility according to applicable laws and regulations.

4.3.6 Accident Analysis Summary

The National Solar Thermal Test Facility is a low-hazard nonnuclear facility and does not require accident analysis.

4.3.7 Reportable Events

Table 4-25 lists the occurrence reports for the National Solar Thermal Test Facility over the past five years.

Table 4-25. Occurrence Reports for the National Solar Thermal Test Facility

Report Number	Title	Category	Description of Occurrence
ALO-KO-SNL-6000SOLAR-1994-0001	Insulating Panel Falls Approximately 120 Ft to the Ground	1F	An insulating panel mounted on an iron frame blew out an open door.
ALO-KO-SNL-6000SOLAR-1994-0002	High Winds Cause Damage to Solar Concentrators at the National Solar Thermal Test Facility	7A	Solar concentrators were damaged by unusually high winds.

4.4 Exterior Sensor Field

The summary of the Exterior Sensor Field and its operations, hazards, and hazard controls is drawn from U.S. Department of Energy (1993a) and Miller (1997).

4.4.1 Purpose and Need

The Exterior Sensor Field provides the capability to test various intrusion detection sensors that are used by DOE, DoD, and the private sector.

4.4.2 Facility Description

The Exterior Sensor Field facility has one permanent building, Building 6600A, several mobile offices and transportable facilities, support trailers, a parking lot, and a sensor test area. Some areas of the facility are fenced. Along the eastern and northern edges of the facility are poles that are interconnected by underground lines.

4.4.3 Program Activities

Table 4-26 shows the programs that use the Exterior Sensor Field and their activities at the facility.

Table 4-26. Program Activities at the Exterior Sensor Field

Program	Activities at the Exterior Sensor Field
Nuclear Safeguards and Security	Testing and evaluation of exterior intrusion sensors.

(Sandia National Laboratories, 1997a)

4.4.4 Summary of Operations

Routine operations at the Exterior Sensor Field include:

- Tests and evaluations of equipment and techniques for intrusion detection.
- Field modifications to meet test specifications, including:
 - Trenching (usually less than 24 in. deep) to bury low-voltage power cables (less than 50 V DC), signal cables, and sensor cables.
 - Installation of sensor bases, which are concrete bases of up to 24 in. in diameter and up to approximately 6 ft in depth, for sensor installation.
 - Installation of camera towers, the bases of which are typically 3 ft square and 8 ft to 10 ft deep.
 - Treatment of the ground surface by placing or removing from the ground such materials as gravel, asphalt, or grass.
 - Removal or installation of fencing as required for sensor mounting.
 - Grading of portions of the field as required for ground profile and for erosion protection and control.

4.4.5 Description of Hazards and Hazard Controls

Hazards at the Exterior Sensor Field include the following:

- Mechanical hazards from all-terrain vehicles, power tools, and manlifts
- Pressure hazards from all-terrain vehicles and manlifts
- Fall hazards from camera towers and manlifts
- Environmental hazards from solder waste

Hazardous materials, including small quantities of solvents, paints, and soldering materials, are stored in approved storage cabinets in one of the trailers. Hazardous wastes are handled according to corporate waste management practices.

For a list of administrative controls for hazards at the Exterior Sensor Field, including ES&H standard operating procedures and required and manager-specified ES&H training, see Miller (1997).

4.4.6 Accident Analysis Summary

The Exterior Sensor Field is a low-hazard nonnuclear facility and does not require accident analysis.

4.4.7 Reportable Events

The Exterior Sensor Field has had no occurrences over the past five years.

4.5 Other Notable Facilities in Leased Areas

Table 4-27 lists other notable SNL facilities other than those discussed in this section that are on land that is leased from the U.S. Air Force. These facilities do not present hazards that require safety analysis or emergency planning documentation, they do not require environmental permits, and their operations do not include outdoor testing.

Table 4-27. Other Facilities on Air Force Land (No Outdoor Testing)

Facility Name	Facility Location
Salvage Yard	West of TA IV
Explosives Storage Igloos	
Explosives Machining Test Facility Complex	CTF
Vat Tank Facility Complex	
Shock Thermodynamics Applied Research Facility	
Coyote Canyon Headquarters	
Large Melt Facility Complex	
Antenna Measurement Facility	
Earth Strain Meter Facility	
Electro Explosive Research Facility	
Radar Cross Section Measurement Facility	
Autonomous Land Vehicle Test Area	
Video Technology Lab	
Site-Deployable Seismic Verification System	
Manzano Saddle Radio Site	Manzano Area

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1.0 INTRODUCTION

This chapter contains tables that summarize all of the activities, material inventory, material consumption, waste, emissions, and resource consumption for all selected and infrastructure facilities. Each of these tables contain the following:

- Values for the “reduced” alternative, which represent the minimum levels of activities, material inventories, material consumption, wastes, emissions, or resource consumption that a facility must support or generate to maintain its mission capability.
- Values for the “base year, no action” alternative, which represent baseline data for facility activities, material inventories, material consumption, wastes, emissions, or resource consumption.
- Values for the “five-year, no action” alternative, which represent estimates by facility personnel for facility activities, material inventories, material consumption, wastes, emissions, or resource consumption over the coming five years.
- Values for the “ten-year, no action” alternative, which represent estimates by facility personnel for facility activities, material inventories, material consumption, wastes, emissions, or resource consumption over the coming ten years.
- Values for the “expanded” alternative, which represent the maximum levels of activities, material inventories, material consumption, wastes, emissions, or resource consumption that a facility can support or generate without regard to budget or programmatic constraints.

A table discussing SNL/NM facilities not designated as notable, including information on types of hazards, programs, and activities, is presented in the *Appendix of SNL/NM Facilities Not Designated Notable* to this document.

2.0 ACTIVITY SCENARIOS

Table 5-1 shows the activity scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information on activities at these facilities, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-1. Activity Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Activity Category	Activity Type	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Advanced Pulsed Power Research Module	Test activities	Accelerator shots	Shots	40	500	1,000	1,000	2,000
	HERMES III		Irradiation of components or materials		40	262	500	500	1,450
	Radiographic Integrated Test Stand		Accelerator shots		100	0	400	600	800
	Repetitive High Energy Pulsed Power Unit I		Radiation production	Tests	100	500	5,000	5,000	10,000
	Repetitive High Energy Pulsed Power Unit II				40	80	160	160	800
	Sandia Accelerator & Beam Research Experiment		Irradiation of components or materials	Shots	0	187	225	225	400
	Saturn				40	65	200	200	500
	Short-Pulse High Intensity Nanosecond X-Radiator				200	1,185	2,500	2,500	6,000
	TESLA				40	40	1,000	1,000	1,300
	Z Machine				84	150	300	300	350
Advanced Manufacturing Processes Laboratory	Advanced Manufacturing Processes Laboratory	Development or production of devices, processes, and systems	Materials, ceramics/glass, electronic, processes, and systems	Operational hours	248,000	248,000	310,000	310,000	347,000
Explosive Components Facility	Explosive Components Facility	Test activities	Neutron generator tests	Tests	500	200	500	500	500
			Explosive testing		300	600	750	850	900
			Chemical analysis	Analyses	500	900	950	1,000	1,250
			Battery tests	Tests	10	50	60	60	100
Infrastructure facilities	Hazardous Waste Management Facility	Other	Collection, packaging, handling, and short-term storage of hazardous and other toxic waste	kg	172,922	193,000	103,700	103,700	579,000
	Radioactive and Mixed Waste Management Facility		Receipt, packaging, and shipping of radioactive waste	lb	816,234	1,632,469	2,122,209	2,122,209	2,693,573
	Steam Plant		Generate and distribute steam to DOE, TA-I, KAFB East, Coronado Club	M-lbs/yr	362	544	544	544	544
	Thermal Treatment Facility		Treatment of waste	lb	0	2.95	336	336	1,200

Table 5-1. Activity Scenarios for SNL/NM Selected and Infrastructure Facilities (Continued)

Designation	Facility Name	Activity Category	Activity Type	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded	
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	Development or production of devices, processes, and systems	Research and development of materials	Operational hours	363,817	395,454	395,454	395,454	395,454	
Microelectronics Development Laboratory	Microelectronics Development Laboratory		Microelectronic devices and systems	Wafers	2,666	4,000	5,000	7,000	7,500	
Neutron Generator Facility	Neutron Generator Facility		Neutron generators	Neutron generators	2,000	600	2,000	2,000	2,000	
Outdoor test facilities	Aerial Cable Facility Complex	Test activities	Aerial target	Tests	0	6	6	6	30	
			Scoring system tests	Series	0	0	1	1	2	
			Drop/pull-down	Tests	2	21	32	38	100	
	Survivability testing		1		0	2	0	2		
	Explosives Applications Laboratory		Explosive testing	50	240	240	240	275 to 360		
	Lurance Canyon Burn Site		Certification testing	1	12	12	12	55		
			Model validation	0	56	56	56	100		
			User testing	0	37	37	37	50		
	Thunder Range		Other	Equipment disassembly and evaluation	Days/year	42	60	82	82	144
			Test activities	Ground truthing tests	Test series	1	1	5	8	10
Physical testing and simulation facilities	Centrifuge Complex	Test activities	Centrifuge	Tests	2	32	46	46	120	
			Impact		0	0	10	10	100	
	Drop/Impact Complex		Drop test		0	18	20	20	50	
			Water impact		1	1	1	1	20	
			Submersion		0	1	1	1	5	
			Underwater blast		0	0	2	2	10	
			Rocket sled test		2	10	10	15	80	
	Sled Track Complex		Explosive testing		0	12	12	12	239	
			Rocket launcher		0	3	4	4	24	
			Free-flight launch		0	40	40	40	150	
	Terminal Ballistics Facility		Projectile impact testing		10	50	80	100	350	
			Propellant testing		4	25	40	50	100	

Table 5-1. Activity Scenarios for SNL/NM Selected and Infrastructure Facilities (Continued)

Designation	Facility Name	Activity Category	Activity Type	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Reactor facilities	Annular Core Research Reactor (DP)	Test activities	Irradiation tests	Tests	0	0	0	1	2 to 3
	Annular Core Research Reactor (Moly-99)		Irradiation of production targets	Targets	40	8	375	375	1,300
	Gamma Irradiation Facility		Tests	Hours	0	1,000	0	0	8,000
	Hot Cell Facility	Development or production of devices, processes, and systems	Processing of production targets	Targets	40	8	375	375	1,300
	New Gamma Irradiation Facility	Test activities	Tests	Hours	0	0	13,000	13,000	24,000
	Sandia Pulsed Reactor		Irradiation tests	Tests	30	100	100	100	200

3.0 MATERIAL INVENTORIES

3.1 Nuclear Material Inventory Scenarios

Table 5-2 shows the nuclear material inventory scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information on nuclear material inventories, see the applicable sections of Chapter 6 through Chapter 14.

**Table 5-2. Nuclear Material Inventory Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Repetitive High Energy Pulsed Power Unit I	Depleted uranium	µg	0	0	10	10	100
	Z Machine	Depleted uranium	mg	0	0	200	200	200
		Deuterium	l	0	0	1,000	1,000	5,000
		Plutonium-239	mg	0	0	200	200	200
		Tritium	Ci	0	0	1,000	1,000	50,000
Explosive Components Facility	Explosive Components Facility	Tritium	Ci	49	49	49	49	49
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	Depleted uranium	mCi	0	0.93	1.0	1.0	1.0
Neutron Generator Facility	Neutron Generator Facility	Tritium	Ci	836	682	836	836	836
Outdoor test facilities	Aerial Cable Facility Complex	Depleted uranium	kg	0	0	0	0	0
	Lurance Canyon Burn Site	Depleted uranium		0	0	0	0	0
	Thunder Range	Americium-241	Ci	0	≤0.52	≤0.52	≤0.52	0.52
		Americium-243		0	≤0.52	≤0.52	≤0.52	0.52
		Normal uranium		0	≤4.2	≤4.2	≤4.2	4.2
		Plutonium-238		0	≤0.62	≤0.62	≤0.62	0.62
Plutonium-239	0	≤0.52	≤0.52	≤0.52	0.52			
Physical testing and simulation facilities	Centrifuge Complex	Depleted uranium	kg	0	0	0	0	0
	Drop/Impact Complex			0	0	0	0	0
	Sled Track Complex			0	0	0	0	0
Reactor facilities	Annular Core Research Reactor (DP)	Enriched uranium	kg	12	12	37	37	85
		Plutonium-239	g	148	148	148	148	8,800
	Annular Core Research Reactor (Moly-99)	Enriched uranium	kg	18.3	25.8	56.7	56.7	56.7
	Gamma Irradiation Facility	Depleted uranium		13,600	13,600	13,600	13,600	13,600
	Hot Cell Facility	Enriched uranium	g	25	25	25	25	125
	Sandia Pulsed Reactor	Enriched uranium	kg	550	550	900	550	1,000
Plutonium-239		g	53	53	10,000	10,000	10,000	

3.2 Radioactive Material Inventory Scenarios

Table 5-3 shows the radioactive material inventory scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information on radioactive material inventories, see the applicable sections of Chapter 6 through Chapter 13.

Table 5-3. Radioactive Material Inventory Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	HERMES III	Activated hardware	kg	0	0	0	0	0
	Radiographic Integrated Test Stand			500	0	500	500	500
	Sandia Accelerator & Beam Research Experiment			0	0	0	0	0
	Z Machine			2,000	50,000	10,000	10,000	10,000
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	C-14	µCi	220	220	220	220	220
Reactor facilities	Annular Core Research Reactor (DP)	Co-60	Ci	33.6	33.6	19	10	33.6
	Hot Cell Facility	Mixed fission products		10,800	3,000	10,800	10,800	54,100

3.3 Sealed Source Inventory Scenarios

Table 5-4 shows the sealed source inventory scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information on sealed source inventories, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-4. Sealed Source Inventory Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	HERMES III	Kr-85	µCi	3.3×10^2	3.3×10^2	3.3×10^2	3.3×10^2	3.3×10^2
	Sandia Accelerator & Beam Research Experiment	Cm-244		0.0	8.54	8.54	8.54	8.54
		Na-22		0.0	1.620×10^{-1}	1.62	1.62	1.62
Advanced Manufacturing Processes Laboratory	Advanced Manufacturing Processes Laboratory	H-3	µCi	2.594×10^6	2.594×10^6	2.594×10^6	2.594×10^6	2.594×10^6
Explosive Components Facility	Explosive Components Facility	Ba-133	µCi	42.8	42.8	42.8	42.8	42.8
		Ni-63		1.020×10^5	1.020×10^5	1.020×10^5	1.020×10^5	1.020×10^5

Table 5-4. Sealed Source Inventory Scenarios for SNL/NM Selected and Infrastructure Facilities (Continued)

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded	
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	Am-241	μCi	12.81	12.81	12.81	12.81	12.81	
		Ba-133		2.228	2.228	2.228	2.228	2.228	
		Cd-109		8.31×10^{-2}					
		Co-57		3.01×10^{-4}					
		Co-60		3.971×10^2					
		Cr-51		2.58×10^{-21}					
		Cs-137		8.526×10^3					
		Eu-152		7.62	7.62	7.62	7.62	7.62	
		Se-75		2.51×10^{-3}					
		Sn-113		1.16×10^{-6}					
		Sr-85		1.36×10^{-10}					
		Tc-99		2.18×10^{-3}					
		Te-123m		4.96×10^{-7}					
		Th-230		2.21×10^{-3}					
Y-88	1.09×10^{-6}	1.09×10^{-6}	1.09×10^{-6}	1.09×10^{-6}	1.09×10^{-6}				
Yb-169	1.43×10^{-14}	1.43×10^{-14}	1.43×10^{-14}	1.43×10^{-14}	1.43×10^{-14}				
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	Fe-55	μCi	0	102.75	102.75	102.75	102.75	
		Th-230		0	1.0	1.0	1.0	1.0	
		U-238		0	4.6	4.6	4.6	4.6	
Neutron Generator Facility	Neutron Generator Facility	Am-241	μCi	101	101	101	101	101	
		Ba-133		49.2	49.2	49.2	49.2	49.2	
		C-14		0.1427	0.1427	0.1427	0.1427	0.1427	
		Cl-36		0.0225	0.0225	0.0225	0.0225	0.0225	
		Co-60		43.8	43.8	43.8	43.8	43.8	
		Cs-137		0.993	0.993	0.993	0.993	0.993	
		Fe-55		0.42	0.42	0.42	0.42	0.42	
		H-3		0.283	0.283	0.283	0.283	0.283	
		Pm-147		288	288	288	288	288	
		Pu-239		0.01716	0.01716	0.01716	0.01716	0.01716	
		Sr-90		4.96629	4.96629	4.96629	4.96629	4.96629	
		Tc-99		0.00851	0.00851	0.00851	0.00851	0.00851	
Reactor facilities	Gamma Irradiation Facility	Co-60	Ci	108,000	108,000	0	0	108,000	
	New Gamma Irradiation Facility	Co-60		150,000	0	1,150,000	1,150,000	2,000,000	
	Sandia Pulsed Reactor	Cf-252	μCi	31	31	31	50	100	
		Co-60		Ci	1.5	1.5	2,000	2,000	2,000
		Cs-137			2.6	2.6	2.6	2.6	10

3.4 Spent Fuel Inventory Scenarios

Table 5-5 shows the spent fuel inventory scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information, see Chapter 13, "Reactor Facilities Source Information," "6.8.2.4, Spent Fuel Inventory Scenario for Spent Fuel From Fuel Elements."

**Table 5-5. Spent Fuel Inventory Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Reactor facilities	Annular Core Research Reactor (Moly-99)	Spent fuel from fuel elements	kg	42	0	0	189	399

3.5 Chemical Inventory Scenarios

3.5.1 Neutron Generator Facility

See Chapter 6, "Neutron Generator Facility Source Information," "9.2.5, Chemical Inventory Scenarios," for a rollup of the chemical inventories at the Neutron Generator Facility.

3.5.2 Microelectronics Development Laboratory

See Chapter 7, "Microelectronics Development Laboratory Source Information," "9.2.5, Chemical Inventory Scenarios," for a rollup of the chemical inventories at the Microelectronics Development Laboratory.

3.5.3 Explosive Components Facility

See Chapter 8, "Explosive Components Facility Source Information," "9.2.5, Chemical Inventory Scenarios," for a rollup of the chemical inventories at the Explosive Components Facility.

3.5.4 Advanced Manufacturing Processes Laboratory

See Chapter 9, "Advanced Manufacturing Processes Laboratory Source Information," "9.2.5, Chemical Inventory Scenarios," for a rollup of the chemical inventories at the Advanced Manufacturing Processes Laboratory.

3.5.5 Integrated Materials Research Laboratory

See Chapter 10, "Integrated Materials Research Laboratory Source Information," "9.2.5, Chemical Inventory Scenarios," for a rollup of the chemical inventories at the Integrated Materials Research Laboratory.

3.5.6 Physical Testing and Simulation Facilities

None of the physical testing and simulation facilities in Tech Area III have inventories of chemicals of concern.

3.5.7 Accelerator Facilities

Table 5-6 shows the chemical inventory scenarios for the accelerator facilities in Tech Area IV. For detailed information on chemical inventories at the accelerator facilities, see Chapter 12, "Accelerator Facilities Source Information."

Table 5-6. Chemical Inventory Scenarios for the Accelerator Facilities

Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
HERMES III	Oxazine 720 perchlorate solution	l	0.3	5	3.8	3.8	11
	Sulforhodamine 640 solution		0.3	2	3.8	3.8	11
	Helium 95%/fluorine 5%	lb	0.375	2.5	4.75	4.75	13.75
Repetitive High Energy Pulsed Power Unit I	Acetone	gal	0.5	1	5	5	7.4
Saturn	Sulfuric acid	l	30	30	30	30	30
	Acetone	gal	0.7	1	3	3	7.7
	Methyl alcohol		0.7	1	3	3	7.7
Z Machine	Fluorine 5% in neon	lb	4.2	7.5	5.1	5.1	10.5

3.5.8 Reactor Facilities

Table 5-7 shows the chemical inventory scenarios for the reactor facilities in Tech Area V. For detailed information on chemical inventories at the reactor facilities, see Chapter 13, "Reactor Facilities Source Information."

Table 5-7. Chemical Inventory Scenarios for the Reactor Facilities

Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Hot Cell Facility	Chloroform	l	1	4	2	2	6
	Ethyl acetate		1	4	2	2	6
	Hydrochloric acid		0.5	0.5	1	1	3
	Hydrogen peroxide 30%		0.5	0.5	1.5	1.5	4
	Nitric acid		1	0.5	3	3	8
	Sodium hydroxide, dry solid, flake, bead	kg	6	11.3	12	12	15
	Sulfuric acid	l	1.5	.5	5	5	15

3.5.9 Outdoor Testing Facilities

None of the outdoor testing facilities in Coyote Test Field have inventories of chemicals of concern.

3.5.10 Infrastructure Facilities

Table 5-8 shows the chemical inventory scenarios for the infrastructure facilities. For detailed information on chemical inventories at the reactor facilities, see Chapter 15, "Infrastructure Facilities Source Information."

Table 5-8. Chemical Inventory Scenarios for the Infrastructure Facilities

Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Radioactive and Mixed Waste Management Facility	Nitric acid solutions	ml	500	500	500	500	500
	Sodium hydroxide, dry solid, flake, bead	lb	1	1	1	1	1
	Zinc metal shot	g	1,000	1,000	1,000	1,000	1,000
Steam Plant	Molybdovanadate reagent	ml	200	200	200	200	200
	Solution S0234 TDS-1	oz	32	32	32	32	32
	Solution S0906 TSC indicator	ml	4,000	4,000	4,000	4,000	4,000

3.6 Explosives Inventory Scenarios

Table 5-9 shows the explosives inventory scenarios for the selected and infrastructure facilities at SNL/NM. For detailed information, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-9. Explosives Inventory Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Radiographic Integrated Test Stand	Bare UNO 1.1	kg	45	0	150	225	300
	Z Machine		g	0	0	1,000	1,000	1,500
Explosive Components Facility	Explosive Components Facility	Bare UNO 1.1	kg	100	130	150	150	150
			Bare UNO 1.2	15	20	30	30	30
			Bare UNO 1.3	20	23	30	30	30
			Bare UNO 1.4	1	2	3	3	3
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	Bare UNO 1.2	g	1,569	1,569	0	0	0
	Thermal Treatment Facility		Bare UNO 1.1	0	5.05	1,440	1,440	10,366
		Bare UNO 1.3	kg	0	0	0.095	0.095	165.7

**Table 5-9. Explosives Inventory Scenarios for SNL/NM
Selected and Infrastructure Facilities (Continued)**

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Outdoor test facilities	Aerial Cable Facility Complex	Bare UNO 1.3	kg	0	0	0	0	0
	Explosives Applications Laboratory	Bare UNO 1.1	g	219,000	327,000	327,000	327,000	490,000
		Bare UNO 1.2		44,000	65,500	65,500	65,500	98,250
		Bare UNO 1.3		1,430,000	2,140,000	2,140,000	2,140,000	3,210,000
		Bare UNO 1.4		1,800,000	2,700,000	2,700,000	2,700,000	4,050,000
Thunder Range	Bare UNO 1.1	kg	0	436	436	436	436	
Physical testing and simulation facilities	Centrifuge Complex	Bare UNO 1.1	kg	0	0	0	0	0
		Bare UNO 1.4	g	0	0	0	0	0
	Sled Track Complex	Bare UNO 1.1	g	0	0	0	0	0
		Bare UNO 1.3		0	0	0	0	0
		Bare UNO 1.4		0	0	0	0	0
	Terminal Ballistics Facility	Bare UNO 1.1	kg	19	19	20	20	25
		Bare UNO 1.2		5	8	8	8	10
		Bare UNO 1.3	g	15,000	20,000	20,000	20,000	25,000
Bare UNO 1.4		15,000		20,000	20,000	20,000	24,000	
Reactor facilities	Annular Core Research Reactor (DP)	Bare UNO 1.2	g	0	0	500	500	500
	Annular Core Research Reactor (Moly-99)			0	0	500	500	500
	Gamma Irradiation Facility	Bare UNO 1.1	g	0	0	0	0	500
	New Gamma Irradiation Facility			0	0	500	500	500
	Sandia Pulsed Reactor			0	1,000	1,000	1,000	1,000

3.7 Other Hazardous Material Inventory Scenarios

Table 5-10 shows the hazardous material inventory scenarios at selected and infrastructure facilities at SNL/NM for hazardous materials other than those that fall into the categories of nuclear or radioactive material, sealed sources, spent fuel, explosives, or chemicals. For detailed information, see Chapter 15, "Infrastructure Facilities Source Information," "6.0 STORAGE TANKS AT SNL/NM," and see the other applicable sections of Chapter 6 through Chapter 15.

4.0 MATERIAL CONSUMPTION

4.1 Nuclear Material Consumption Scenarios

Table 5-11 shows the nuclear material consumption scenarios at selected and infrastructure facilities at SNL/NM. For detailed information, see the applicable sections of Chapter 6 through Chapter 15.

**Table 5-10. Other Hazardous Material Inventory Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded	
Accelerator facilities	Advanced Pulsed Power Research Module	Insulator oil	gal	130,000	130,000	130,000	130,000	130,000	
	HERMES III		gal	160,000	160,000	160,000	160,000	160,000	
	Radiographic Integrated Test Stand		gal	40,000	0	40,000	40,000	40,000	
	Repetitive High Energy Pulsed Power Unit I		gal	6,000	6,000	6,000	6,000	6,000	
	Repetitive High Energy Pulsed Power Unit II	Contaminated meat products	lb	0	100	100	100	100	
	Sandia Accelerator & Beam Research Experiment	Sandia Accelerator & Beam Research Experiment	Insulator oil	gal	5,000	5,000	5,000	5,000	5,000
				gal	30,000	30,000	30,000	30,000	30,000
				gal	300,000	300,000	300,000	300,000	300,000
				gal	1,000	1,000	1,000	1,000	1,000
				gal	10,000	10,000	20,000	20,000	20,000
				gal	700,000	700,000	700,000	700,000	700,000
gal				700,000	700,000	700,000	700,000	700,000	
Infrastructure facilities	Hazardous Waste Management Facility	Propane	lb	0	396	396	396	1,188	
	Radioactive and Mixed Waste Management Facility	Liquid nitrogen	l	8,320	8,320	8,320	8,320	8,320	
		Propane	gal	6,630	6,630	6,630	6,630	6,630	
	Steam Plant	Diesel fuels		1.5 million	1.5 million	1.5 million	1.5 million	1.5 million	
		Propane		150	300	300	300	300	
		Water treatment chemicals		1,174	1,752	1,752	1,752	1,752	
	Thermal Treatment Facility	Propane		500	500	500	500	500	
Outdoor test facilities	Containment Technology Test Facility - West	Adhesives	g	500	500	500	0	500	
	Explosives Applications Laboratory	Film developer/fixer	gal	10	10	10	10	20	

Table 5-11. Nuclear Material Consumption Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced		Base Year, No Action		Five-Year, No Action		Ten-Year, No Action		Expanded	
				Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity
Accelerator facilities	Repetitive High Energy Pulsed Power Unit I	Depleted uranium	µg	0	0	0	0	2	10	2	10	20	100
	Z Machine		mg	N/A	0	N/A	0	N/A	800	N/A	800	N/A	2,000
		Deuterium	l	N/A	0	N/A	0	N/A	3,750	N/A	3,750	N/A	5,000
		Plutonium-239	mg	N/A	0	N/A	0	N/A	800	N/A	800	N/A	2,000
		Tritium	Ci	N/A	0	N/A	0	N/A	2,500	N/A	2,500	N/A	7,500
Neutron Generator Facility	Neutron Generator Facility	Tritium	Ci	14	106	60	386	60	386	60	386	100	652
Outdoor test facilities	Aerial Cable Facility Complex	Depleted uranium	kg	0	0	0	0	0	0	0	0	0	0
	Lurance Canyon Burn Site			0	0	0	0	0	0	0	0	0	0
Physical testing and simulation facilities	Centrifuge Complex	Depleted uranium	kg	0	0	0	0	0	0	0	0	0	0
	Drop/Impact Complex			0	0	0	0	0	0	0	0	0	0
	Sled Track Complex			0	0	0	0	0	0	0	0	0	0
Reactor facilities	Annular Core Research Reactor (DP)	Enriched uranium	g	0	0	0	0	0	0	0	0	0	2
	Annular Core Research Reactor (Moly-99)		kg	0	0	0	0	0	0.38	0	10.6	0	16
	Hot Cell Facility		0	1.0	0	0.2	0	9.4	0	9.4	0	32.5	

4.2 Radioactive Material Consumption Scenarios

Only one SNL/NM selected facility, the New Gamma Irradiation Facility, anticipates consumption of radioactive material. For detailed information, see Chapter 13, “Reactor Facilities Source Information,” Section 4.8.3.2, “Radioactive Material Consumption Scenario for Co-60.”

4.3 Chemical Consumption Scenarios

Information initially provided for this section resides in the Facility Information Manager database and will be made available to the analysts responsible for preparing the sitewide environmental impact statement.

4.4 Explosives Consumption Scenarios

Table 5-12 shows the explosives consumption scenarios at selected and infrastructure facilities at SNL/NM. For detailed information, see the applicable sections of Chapter 6 through Chapter 15.

5.0 WASTES

5.1 Low-Level Radioactive Waste Scenarios

Table 5-13 shows the low-level radioactive waste scenarios for SNL/NM selected and infrastructure facilities. For detailed information on low-level radioactive waste at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

5.2 Transuranic Waste Scenarios

Table 5-14 shows the transuranic waste scenarios for SNL/NM selected and infrastructure facilities. For detailed information on transuranic waste at selected and infrastructure facilities, see the applicable sections of Chapter 12, “Accelerator Facilities Source Information,” Chapter 13, “Reactor Facilities Source Information,” and Chapter 15, “Infrastructure Facilities Source Information.”

**Table 5-12. Explosives Consumption Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Material	Units	Reduced		Base Year, No Action		Five-Year, No Action		Ten-Year, No Action		Expanded	
				Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity	Pkgs	Quantity
Accelerator facilities	Radiographic Integrated Test Stand	Bare UNO 1.1	kg	N/A	45	N/A	0	N/A	150	N/A	225	N/A	300
	Z Machine		g	N/A	0	N/A	0	N/A	11,250	N/A	11,250	N/A	37,500
Explosive Components Facility	Explosive Components Facility	Bare UNO 1.1	kg	N/A	10	N/A	15	N/A	18	N/A	18	N/A	18
		Bare UNO 1.2		N/A	0.5	N/A	2	N/A	4	N/A	4	N/A	4
		Bare UNO 1.3		N/A	1	N/A	3	N/A	5	N/A	5	N/A	5
		Bare UNO 1.4		N/A	2	N/A	10	N/A	14	N/A	14	N/A	14
Outdoor test facilities	Aerial Cable Facility Complex	Bare UNO 1.1	kg	0	0	12	18.9	18	28.4	22	34.6	50	78.8
		Bare UNO 1.3		40	480	86	1,514	215	3,268	255	3,814	2,270	22,930
		Bare UNO 1.4	g	8	71	46	410	48	625	83	741	260	2,314
	Explosives Applications Laboratory	Bare UNO 1.1	kg	86	117,000	128	175,000	128	175,000	128	175,000	192	263,000
		Bare UNO 1.2		34	670	50	1,000	50	1,000	50	1,000	75	1,500
		Bare UNO 1.3		170	6,700	250	10,000	250	10,000	250	10,000	375	15,000
		Bare UNO 1.4		34	670	50	1,000	50	1,000	50	1,000	75	1,500
Physical testing and simulation facilities	Centrifuge Complex	Bare UNO 1.1	kg	0	0	0	0	0	0	0	0	10	7
		Bare UNO 1.3		0	0	0	0	0	0	0	0	10	2,272
		Bare UNO 1.4	g	0	0	0	0	10	89	10	89	100	890
	Drop/Impact Complex	Bare UNO 1.1	kg	0	0	0	0	0	0	0	0	10	6.8
		Bare UNO 1.3		6	55	6	55	6	55	6	55	120	1,100
		Bare UNO 1.4	g	4	36	22	196	24	214	24	214	130	1,157
	Sled Track Complex	Bare UNO 1.1	kg	0	0	0	0	12	400	12	400	239	2,761
		Bare UNO 1.3		40	480	246	3,354	248	3,382	348	4,745	1,588	36,170
		Bare UNO 1.4	g	0	0	3	27	4	36	4	36	24	214
	Terminal Ballistics Facility	Bare UNO 1.1	kg	1	0.4	4	2	8	3.2	8	4	28	14
		Bare UNO 1.2		1	0.6	6	3	10	4.8	12	6	42	21
		Bare UNO 1.3		1	0.4	2	2	6	3.2	8	4	28	14
		Bare UNO 1.4		1	0.4	4	2	6	3.2	8	4	28	14

Table 5-13. Low-Level Radioactive Waste Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	HERMES III	ft ³	0.04	0.25	0.48	0.48	1.38
	Radiographic Integrated Test Stand	kg	15	0	60	90	120
	Sandia Accelerator & Beam Research Experiment	ft ³	0.0	4.0	4.8	4.8	8.4
	Z Machine		12	44	20	20	28
Explosive Components Facility	Explosive Components Facility	ft ³	190	95	190	190	190
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	ft ³	5,937	11,874	15,436	15,436	19,592
Microelectronics Development Laboratory	Microelectronics Development Laboratory	ft ³	3	4	5	7	8
Neutron Generator Facility	Neutron Generator Facility	kg	4,000	3,000	4,000	4,000	4,000
Reactor facilities	Annular Core Research Reactor (DP)	ft ³	0	0	0	35	170
	Annular Core Research Reactor (Moly-99)		56	56	370	370	1,090
	Gamma Irradiation Facility		56	56	0	0	126
	Hot Cell Facility		270	100	2,200	2,200	5,000
	New Gamma Irradiation Facility		56	0	92	92	126
	Sandia Pulsed Reactor		kg	440	440	440	440

Table 5-14. Transuranic Waste Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Z Machine	ft ³	0	0	8	8	16
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	ft ³	107	214	278	278	353
Reactor facilities	Annular Core Research Reactor (DP)	ft ³	0	0	0	0	5
	Sandia Pulsed Reactor		0	0	2	2	5

5.3 Mixed Waste Scenarios

5.3.1 Low-Level Mixed Waste Scenarios

Table 5-15 shows the low-level mixed waste scenarios for SNL/NM selected and infrastructure facilities. For detailed information on low-level mixed waste at selected and infrastructure facilities, see “9.4.3 Mixed Waste,” in Chapter 6, “Neutron Generator Facility Source Information,” and Chapter 8, “Explosive Components Facility Source Information.” Also see the applicable sections of Chapter 13, “Reactor Facilities Source Information,” and Chapter 15, “Infrastructure Facilities Source Information.”

Table 5-15. Low-Level Mixed Waste Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No-Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Explosive Components Facility	Explosive Components Facility	kg	1,000	1,000	1,000	1,000	1,000
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	ft ³	2,677	5,353	6,959	6,959	8,833
Neutron Generator Facility	Neutron Generator Facility	kg	300	150	300	300	300
Reactor facilities	Annular Core Research Reactor (DP)	ft ³	0	0	0	0	5
	Hot Cell Facility		5	7	17	17	40
	Sandia Pulsed Reactor		4	4	4	4	14

Normal operations at the physical testing and simulation facilities in Tech Area III and the outdoor testing facilities in Coyote Test Field do not produce low-level mixed waste. However, while tests are designed to preclude releases or radioactive and hazardous materials under normal operations, materials from test assemblies could be accidentally released to the ground following impacts or explosions. In this event, cleanup of the area would produce some low-level mixed radioactive waste. Quantitative estimates are not available.

5.3.2 Transuranic Mixed Waste Scenarios

Table 5-16 shows the transuranic mixed waste scenarios for SNL/NM selected and infrastructure facilities. For detailed information on transuranic mixed waste at selected and infrastructure facilities, see the applicable sections of Chapter 13, "Reactor Facilities Source Information," and Chapter 15, "Infrastructure Facilities Source Information."

Table 5-16. Transuranic Mixed Waste Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	ft ³	8	16	21	21	27
Reactor facilities	Annular Core Research Reactor (DP)	ft ³	0	0	0	0	5
	Sandia Pulsed Reactor		0	0	2	2	5

5.4 Hazardous Waste Scenarios

Table 5-17 shows the hazardous waste scenarios for SNL/NM selected and infrastructure facilities. For detailed information on hazardous waste at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

**Table 5-17. Hazardous Waste Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Units	Reduced	Base Year, No-Action	Five-Year, No-Action	Ten-Year, No-Action	Expanded
Accelerator facilities	Advanced Pulsed Power Research Module	kg	5	50	100	100	200
	HERMES III		25	167	316	316	915
	Radiographic Integrated Test Stand		34	0	136	204	272
	Repetitive High Energy Pulsed Power Unit I		0	0	5	5	10
	Repetitive High Energy Pulsed Power Unit II		0	0	1	1	1
	Sandia Accelerator & Beam Research Experiment		0	63	76	76	132
	Saturn		100	167	501	501	1,286
	Short-Pulse High Intensity Nanosecond X-Radiator		3.6	21	45	45	107
	TESLA		2	2	50	50	65
	Z Machine		400	750	1,000	1,000	1,250
Advanced Manufacturing Processes Laboratory	Advanced Manufacturing Processes Laboratory	kg	4,732	4,732	5,915	5,915	6,625
Explosive Components Facility	Explosive Components Facility	kg	200	360	400	500	500
Infrastructure facilities	Hazardous Waste Management Facility	kg	0	16,843	9,095	9,095	50,529
	Thermal Treatment Facility		0	0	76	76	272
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	kg	2,000	2,400	2,100	1,850	2,000
Microelectronics Development Laboratory	Microelectronics Development Laboratory	kg	1,688	2,520	3,150	4,410	4,738
Neutron Generator Facility	Neutron Generator Facility	kg	3,680	2,760	3,680	3,680	3,680
Outdoor test facilities	Aerial Cable Facility Complex	kg	5	5	5	5	9
	Containment Technology Test Facility - West	g	100	100	100	0	100
	Explosives Applications Laboratory	kg	0.5	1	1	1	1.5 to 2
	Lurance Canyon Burn Site		900	900	900	900	900
Physical testing and simulation facilities	Centrifuge Complex	kg	12	10	12	12	15
	Drop/Impact Complex	g	0	0	0	0	0
	Sled Track Complex	kg	3	15	15	15	50
	Terminal Ballistics Facility		0	0.25	0.50	0.50	0.75
Reactor facilities	Annular Core Research Reactor (DP)	ft ³	0	0	0	2	14
	Annular Core Research Reactor (Moly-99)		7	7	14	14	30
	Gamma Irradiation Facility		7	7	0	0	14
	Hot Cell Facility		7	7	14	14	22
	New Gamma Irradiation Facility		7	0	14	14	14
	Sandia Pulsed Reactor		7	7	14	14	30

6.0 EMISSIONS

6.1 Radioactive Air Emissions Scenarios

Table 5-18 shows the radioactive air emission scenarios for SNL/NM selected and infrastructure facilities. For detailed information on radioactive air emissions at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-18. Radioactive Air Emission Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded	
Accelerator facilities	HERMES III	N-13	Ci	1×10^{-4}	6.55×10^{-4}	12.45×10^{-4}	12.45×10^{-4}	36.03×10^{-4}	
		O-15		1×10^{-5}	6.55×10^{-5}	12.45×10^{-5}	12.45×10^{-5}	36.03×10^{-5}	
	Radiographic Integrated Test Stand	N-13		0.02	0	0.08	0.12	0.16	
	Z Machine	N-13		0	0.042	0	0	0	
		O-15		0	0.005	0	0	0	
Explosive Components Facility	Explosive Components Facility	H-3	Ci	2×10^{-3}	2×10^{-3}	1.5×10^{-3}	2×10^{-3}	2×10^{-3}	
Infrastructure facilities	Radioactive and Mixed Waste Management Facility	H-3	Ci	2.203	2.203	2.203	2.203	2.203	
Neutron Generator Facility	Neutron Generator Facility	H-3	Ci	156	94	156	156	156	
Reactor facilities	Annular Core Research Reactor (DP)	Ar-41	Ci	0	2.6	2.6	2.6	7.8	
		H-3		0.24	0	1.1	1.1	2.2	
	Hot Cell Facility	Ar-41		0.24	35.4	1.1	1.1	2.2	
		I-131		0.117	0.00196	1.17	1.17	3.9	
		I-132		0.3	0.000129	3.0	3.0174	10.0	
		I-133		0.54	0.00951	5.4	5.4	18.0	
		I-135		0.33	0.00132	3.3	3.3	11	
		Kr-83m		19.8	0.0000957	198.0	198.0	660.0	
		Kr-85		0.019	0.00153	0.19	0.19	0.63	
		Kr-87		5.7	0.0294	57.0	57.0	190	
		Kr-88		48.0	0.527	480.0	480.0	1600	
		Xe-133		216.0	17.5	2,160.0	2,160.0	7,200.0	
		Xe-133m		10.2	0.768	102.0	102.0	340.0	
		Xe-135		207.0	14.7	2,070.0	2,070.0	6,900.0	
		I-134		0.022	0	0.22	0.22	0.72	
		Xe-135m		36	0.976	360	360	1,200	
		Kr-85m		29.0	0.587	290.0	290.0	970.0	
		Xe-131m		0.18	0.000345	1.8	1.8	5.9	
		Sandia Pulsed Reactor		Ar-41	2.85	9.5	9.5	9.5	30.0

6.2 Chemical Air Emissions

Information on an extensive list of chemicals was obtained from the SNL/NM Chemical Inventory System (CIS). For the air emissions analysis, the entire annual inventory of these chemicals was assumed to have been released over a year of operations for each specific facility (i.e., the annual inventory was divided by facility operating hours). The emissions from this release were then subjected, on a chemical-by-chemical basis, to a progressive series of screening steps for potential exceedances of both regulatory and human health thresholds. For those chemicals found to exceed this screening, process knowledge was used to derive emission factors. The emission factors for these chemicals were then modeled using the U.S. Environmental Protection Agency's *Industrial Source Complex Air Quality Dispersion Model, Version 3*. The results of this modeling are discussed as part of the analysis in support of the SNL/NM site-wide environmental impact statement.

6.3 Open Burning Scenarios

Table 5-19 shows the open burning scenarios for SNL/NM selected and infrastructure facilities. For detailed information on open burning at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

6.4 Process Wastewater Scenarios

Table 5-20 shows the process wastewater effluent scenarios for SNL/NM selected and infrastructure facilities. For detailed information on process wastewater effluent at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

7.0 RESOURCE CONSUMPTION

7.1 Process Water Consumption Scenarios

Table 5-21 shows the process water consumption scenarios for SNL/NM selected and infrastructure facilities. For detailed information on process water consumption at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

7.2 Process Electricity Consumption Scenarios

Table 5-22 shows the process electricity consumption scenarios for SNL/NM selected and infrastructure facilities. For detailed information on process electricity consumption at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-19. Open Burning Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Material	Units	Reduced		Base Year, No Action		Five-Year, No Action		Ten-Year, No Action		Expanded	
				Quantity	Burns	Quantity	Burns	Quantity	Burns	Quantity	Burns	Quantity	Burns
Infrastructure facilities	Thermal Treatment Facility	Propane	gal	0	0	8	4	30	15	30	15	120	60
Outdoor test facilities	Lurance Canyon Burn Site	JP-8 aviation fuel	gal	1,500	1	5,000	15	5,000	15	5,000	15	25,000	50
		Rocket propellant	kg	0	0	0	0	0	0	0	0	7,500	5
		Wood	kg	0	0	1,000	2	1,000	2	1,000	2	5,000	10
Physical testing and simulation facilities	Sled Track Complex	Explosives	kg	0	0	0	0	400	12	400	12	1,670	79

Table 5-20. Process Wastewater Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Explosive Components Facility	Explosive Components Facility	gal	3,200,000	4,800,000	5,000,000	5,000,000	6,400,000
Microelectronics Development Laboratory	Microelectronics Development Laboratory	gal	44,089,812	44,089,812	55,112,265	77,157,171	77,157,171
Neutron Generator Facility	Neutron Generator Facility	gal	5,000,000	3,000,000	5,000,000	5,000,000	5,000,000
Outdoor test facilities	Lurance Canyon Burn Site	gal	25,000	25,000	25,000	25,000	25,000
Reactor facilities	Annular Core Research Reactor (DP)	gal	0	0	0	10,000	50,000
	Annular Core Research Reactor (Moly-99)		240,000	125,000	1,000,000	1,000,000	2,190,000

Table 5-21. Process Water Consumption Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Explosive Components Facility	Explosive Components Facility	gal	4 million	6 million	6.5 million	6.5 million	7 million
Infrastructure facilities	Steam Plant	gal	18 million	18 million	18 million	18 million	18 million
Microelectronics Development Laboratory	Microelectronics Development Laboratory	gal	77 million	77 million	77 million	77 million	77 million
Neutron Generator Facility	Neutron Generator Facility	gal	5 million	3 million	5 million	5 million	5 million
Outdoor test facilities	Lurance Canyon Burn Site	gal	0	0	0	0	0
Reactor facilities	Annular Core Research Reactor (DP)	gal	0	0	0	10,000	100,000
	Annular Core Research Reactor (Moly-99)		1.2 million	600,000	5 million	5 million	11 million
	Gamma Irradiation Facility		17,000	17,000	0	0	17,000
	New Gamma Irradiation Facility		0	0	166,000	166,000	255,000

Table 5-22. Process Electricity Consumption Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Explosive Components Facility	Explosive Components Facility	kw-hr	2,500,000	2,875,000	3,100,000	3,100,000	3,400,000
Infrastructure facilities	Steam Plant	kw-hr	800,000	1,200,000	1,200,000	1,200,000	1,200,000
Microelectronics Development Laboratory	Microelectronics Development Laboratory	kw-hr	28,640,059	28,640,059	28,640,059	28,640,059	28,640,059

7.3 Boiler Energy Consumption Scenarios

Table 5-23 shows the boiler energy consumption scenarios for SNL/NM selected and infrastructure facilities. For detailed information on boiler energy consumption at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-23. Boiler Energy Consumption Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Fuel	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Explosive Components Facility	Explosive Components Facility	Natural gas	ft ³	16 million	24 million	27 million	27 million	29 million
Microelectronics Development Laboratory	Microelectronics Development Laboratory	Natural gas	ft ³	34.3 million	34.3 million	34.3 million	34.3 million	34.3 million
Infrastructure facilities	Steam Plant	Natural gas	Std ft ³	519 million	779 million	779 million	779 million	779 million

7.4 Facility Staffing Scenarios

Table 5-24 shows the staffing scenarios for SNL/NM selected and infrastructure facilities. For detailed information on staffing at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

Table 5-24. Staffing Scenarios for SNL/NM Selected and Infrastructure Facilities

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Advanced Pulsed Power Research Module	FTEs	5	5	7	7	7
	HERMES III		10	12	15	15	22
	Radiographic Integrated Test Stand		4	0	6	6	10
	Repetitive High Energy Pulsed Power Unit I		2	5	8	8	10
	Repetitive High Energy Pulsed Power Unit II		0.45	0.9	1.4	1.4	3
	Sandia Accelerator & Beam Research Experiment		0.5	4.0	5.0	5.0	6.0
	Saturn		4	5	10	10	18
	Short-Pulse High Intensity Nanosecond X-Radiator		0.5	2.7	3.5	3.5	5
	TESLA		1	1	3	3	5
	Z Machine		50	50	85	85	115
Advanced Manufacturing Processes Laboratory	Advanced Manufacturing Processes Laboratory	FTEs	150	150	184	184	204
Explosive Components Facility	Explosive Components Facility	FTEs	94	81	94	94	102
Infrastructure facilities	Hazardous Waste Management Facility	FTEs	1	13	9	9	35
	Radioactive and Mixed Waste Management Facility	FTEs	15	30	39	39	49
	Steam Plant	FTEs	12	17	17	17	17
	Thermal Treatment Facility	FTEs	0.1	0.1	0.2	0.2	1
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	FTEs	230	250	250	250	250
Neutron Generator Facility	Neutron Generator Facility	FTEs	280	180	280	280	280
Outdoor test facilities	Aerial Cable Facility Complex	FTEs	6	8	8	10	24
	Containment Technology Test Facility - West		12	12	12	0	12
	Explosives Applications Laboratory		2	3	3	3	6
	Lurance Canyon Burn Site		3.5	4.5	4.5	4.5	11
	Thunder Range		0.8	1.1	1.5	1.5	2.6
Physical testing and simulation facilities	Centrifuge Complex	FTEs	3.5	3.5	4.5	4.5	10
	Drop/Impact Complex		2.5	2.5	2.5	2.5	8
	Sled Track Complex		8	8	8	8	40
	Terminal Ballistics Facility		0.05	0.3	0.4	0.6	2

**Table 5-24. Staffing Scenarios for SNL/NM
Selected and Infrastructure Facilities (Continued)**

Designation	Facility Name	Units	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Reactor facilities	Annular Core Research Reactor (DP)	FTEs	1	1	1	1	8
	Annular Core Research Reactor (Moly-99)		7	9	14	14	22
	Gamma Irradiation Facility		2	2	0	0	3
	Hot Cell Facility		12	12	32	32	55
	New Gamma Irradiation Facility		2	0	3	3	4
	Sandia Pulsed Reactor		8	10	12	10	17

7.5 Expenditures Scenarios

Table 5-25 shows the expenditures scenarios for SNL/NM selected and infrastructure facilities. For detailed information on expenditures at selected and infrastructure facilities, see the applicable sections of Chapter 6 through Chapter 15.

**Table 5-25. Expenditures Scenarios for SNL/NM
Selected and Infrastructure Facilities**

Designation	Facility Name	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Accelerator facilities	Advanced Pulsed Power Research Module	\$1.5 million	\$3.5 million	\$5 million	\$5 million	\$5.5 million
	HERMES III	\$1.98 million	\$2.4 million	\$3.0 million	\$3.0 million	\$4.4 million
	Radiographic Integrated Test Stand	\$1.75 million	0	\$2.25 million	\$2.25 million	\$4 million
	Repetitive High Energy Pulsed Power Unit I	\$750,000	\$1.5 million	\$2.5 million	\$2.5 million	\$5.5 million
	Repetitive High Energy Pulsed Power Unit II	\$126,000	\$252,000	\$353,000	\$353,000	\$754,000
	Sandia Accelerator & Beam Research Experiment	\$80,000	\$640,000	\$800,000	\$800,000	\$960,000
	Saturn	\$1.2 million	\$1.5 million	\$3 million	\$3 million	\$5.4 million
	Short-Pulse High Intensity Nanosecond X-Radiator	\$70,000	\$300,000	\$500,000	\$500,000	\$710,000
	TESLA	\$500,000	\$50,000	\$1 million	\$1 million	\$1.6 million
	Z Machine	\$800,000	\$1.2 million	\$3 million	\$3 million	\$4 million
Advanced Manufacturing Processes Laboratory	Advanced Manufacturing Processes Laboratory	\$32 million	\$32 million	\$40 million	\$40 million	\$45 million
Explosive Components Facility	Explosive Components Facility	\$2.1 million	\$1.7 million	\$2.1 million	\$2.1 million	\$2.5 million
Infrastructure facilities	Hazardous Waste Management Facility	0	\$900,000	\$490,000	\$490,000	\$2.7 million
	Radioactive and Mixed Waste Management Facility	\$160,000	\$320,000	\$416,000	\$416,000	\$528,000
	Steam Plant	\$2.4 million	\$2.8 million	\$2.83 million	\$2.83 million	\$2.87 million
	Thermal Treatment Facility	\$10,000	\$10,000	\$20,000	\$20,000	\$100,000

**Table 5-25. Expenditures Scenarios for SNL/NM
Selected and Infrastructure Facilities (Continued)**

Designation	Facility Name	Reduced	Base Year, No Action	Five-Year, No Action	Ten-Year, No Action	Expanded
Integrated Materials Research Laboratory	Integrated Materials Research Laboratory	\$48 million	\$45 million	\$55 million	\$60 million	\$62 million
Neutron Generator Facility	Neutron Generator Facility	\$55 million	\$30 million	\$55 million	\$55 million	\$55 million
Outdoor test facilities	Aerial Cable Facility Complex	\$150,000	\$250,000	\$350,000	\$380,000	\$725,000
	Containment Technology Test Facility - West	\$2 million	\$2 million	\$2 million	0	\$2 million
	Explosives Applications Laboratory	\$435,500	\$650,000	\$747,500	\$859,625	\$975,000
	Lurance Canyon Burn Site	\$150,000	\$250,000	\$275,000	\$300,000	\$625,000
Physical testing and simulation facilities	Centrifuge Complex	\$250,000	\$400,000	\$450,000	\$480,000	\$750,000
	Drop/Impact Complex	\$31,000	\$50,000	\$55,000	\$60,000	\$146,000
	Sled Track Complex	\$190,000	\$334,000	\$376,000	\$451,000	\$1.95 million
	Terminal Ballistics Facility	\$3,000	\$8,500	\$9,500	\$11,000	\$12,000
Reactor facilities	Annular Core Research Reactor (DP)	\$200,000	\$200,000	\$200,000	\$5 million	\$12 million
	Annular Core Research Reactor (Moly-99)	0	\$200,000	\$4.5 million	\$4 million	0
	Gamma Irradiation Facility	0	0	0	0	0
	Hot Cell Facility	0	0	\$4 million	0	0
	New Gamma Irradiation Facility	0	0	\$6 million	\$500,000	\$1 million
	Sandia Pulsed Reactor	0	0	\$5 million	0	\$6 million

8.0 REFERENCES

Sandia National Laboratories, 1998, Facilities Information Manager Database, database maintained by the Sitewide EIS Support Project, Sandia National Laboratories, Albuquerque, New Mexico.

